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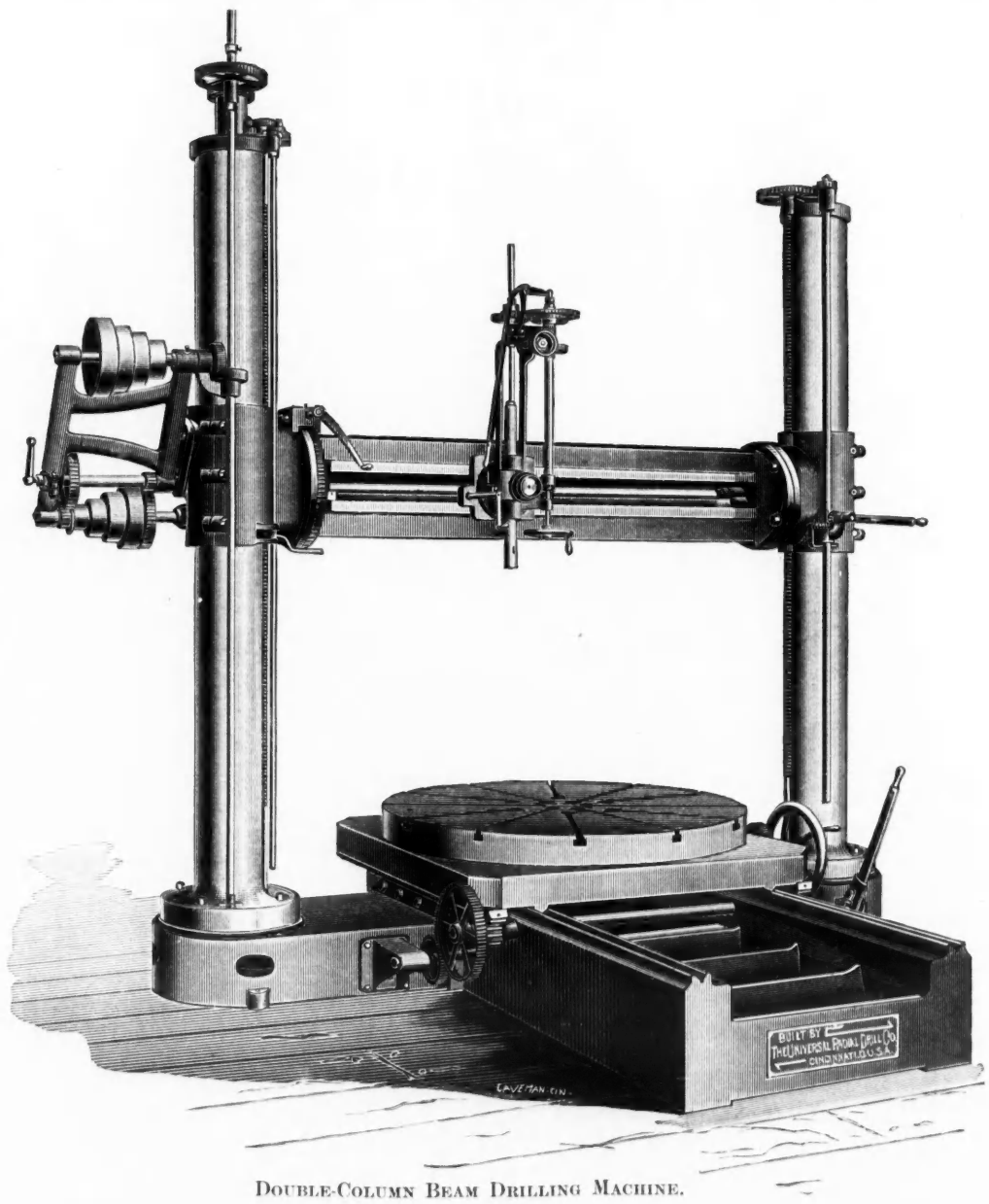
Double-Column Beam Drilling Machine.

One of our prominent New England engine building establishments has recently had constructed a machine, called by the builders a double-column universal beam drill, an engraving of which we present herewith. It is especially adapted to drilling the holes on Corliss or other engine cylinders, pump cylinders, etc., but, of course, is equally well adapted to heavy pieces of work of other kinds. The beam is supported at each end by columns 13″ diameter and 12 feet high, on each of which there is a screw for raising or lowering the beam. This may be done rapidly by power, by means of the gears shown on top of the left-hand column, or by hand, by means of those on the right-hand column, which are worked by the crank handle, bevel gears, and splined rod at the right. The screws are connected together by bevel gears, and a shaft which passes through the base from one column to the other, there being at the center of this shaft a coupling which admits of adjustment to bring the beam parallel with the table.

The beam can be revolved completely around by means of the worm and worm teeth shown at the left, and can be clamped to drill at any angle to the table, or set with the spindle in a horizontal position for drilling upon the sides of work.

The diameter of the round chucking table is six feet, and it can be revolved completely around by means of the large hand wheel at the right, thus enabling the operator to bring any part of the work under the spindle, or to present any side of it to the spindle when the latter is in a horizontal position. The square table has a movement of six feet upon the bed, and is moved by means of two racks with suitable gearing, actuated by the ratchet lever shown at the right.

The greatest distance, from the spindle to the chucking table, is 8 feet, 7 inches, and the horizontal travel of the head is 6 feet, 1½ inches. It swivels to any angle upon the rail, and feeds automatically or by hand in any direction. The spindle is 2⅞″ diameter, and has a travel of 24″. The machine weighs about 26,000 pounds, and was built by The Cincinnati Universal Radial Drill Co., Cincinnati, Ohio.



DOUBLE-COLUMN BEAM DRILLING MACHINE.

Practical Details of Blacksmithing.

BY B. F. SPALDING.

HEATING FURNACES CONTINUED—A LARGER FURNACE—SCREENING HEAT—SPECIAL FIRE-BRICK—INDEPENDENT WIND-BOXES—MAKING BRICK MOUTH-PIECES—HEATING LONG BARS.

The furnace shown in Fig. 5 (page 2) was designed for taking longer heats, on larger iron, with equal rapidity, without the use of a water front or back. It is not designed that the work to be heated by this shall pass through the fuel, but that it shall lay very near to it, and receive directly a large part of the heat required to raise its temperature, and the rest by reverberation from the hollow top and sides. It is quite an expensive furnace to make, and it is only in places where large quantities of work are to be done that the outlay will be warrantable. When it is properly bonneted it is a very comfortable furnace to work at.

Various experiments have been tried to keep the heat of furnaces from affecting the operators. In one of these, often repeated, a wind-pipe was laid parallel with and just below the mouth of a furnace, and this had a series of holes drilled in the top of it close together for the whole length of the mouth, which was 24 inches, so that when the proper valve was turned, the cold air shot upwards in a sheet, the object being to cut off the heat, which poured out, by the cold blast. The scheme proved utterly futile. If anything, the heat was more unbearable. The oxygen of the cold blast seemed to furnish excellent food to nourish whatever unconsumed carbon might find its way to it, and this, added to the normal radiation, made a heat too scorching to face. It carried a very warm conviction that the sunshine through a cyclone might be as hot as through a zephyr. Screens to prevent the radiation from reaching the workman may be made of sheet iron, and these can fall as low as may be, so as not to interfere with his view of the work, and below them can hang woven wire screens, low enough to keep the heat from his breast and face without obstructing the free motion of his arms in putting in and taking out the work. There may be three or four of these, one behind the other, the one nearest the fire being of the coarsest wire and mesh, and the outside one being as fine as that used for house window screens. Each one obstructs a portion of the heat, and the draft of air from below carries it up and off into the flue, or, if there is no flue, then into the upper part of the shop, and off through the ventilator. They need not be separated from each other more than three inches; the spaces between them are only to secure the upward rush of the lower air. In front of the hottest fire the outer one should not become more than sissing hot. The day when, for want of better knowledge, men are obliged to work in places where the temperature is over 110° Fahr. has gone by; only parsimony or indifference to their comfort can continue it. A man keeping a brute in a place hotter than that would be prosecuted by the society for the prevention of cruelty to animals. It is but fair to say, however, that man is the only true salamander. It is within my knowledge that men can and do accustom themselves to work in a temperature as high as 135° Fahr., and while they perspire freely, suffer no injury, except from exhaustion. A man may enter an oven used for burning bones, when the iron flooring, on which he steps, is red hot; and men engaged in japanning often carry their work into the heating oven and deposit it, when the temperature is between 300° and 400°, and when, if their watch-chain hits against their bare arms, it will burn them. Dead flesh would cook with less heat, but life furnishes men and horses with the essential preserving principles of the water front furnace, a supply of moisture near the surface, and its escape with the redundance of heat. Nevertheless, the oftener the furnace is heated the shorter will be its existence.

The peculiar features of the furnace, shown in Fig. 5, are the plan of the capping, and the multiplicity of the wind-boxes. The plan of the capping is shown by the view of the cross-section, shown in Fig. 7, as is also the lining, the arrangement of the wind-pipe, and the mode of applying the plan of dropping the bottom of the wind-box and the grate simultaneously by connecting them together. The plan itself was used in Millbury, and around through central Massachusetts, by the old scythe makers, thirty or forty years ago.

The letters on Figs. 5 and 7 refer to the same things. The pieces marked *C* constitute the abutments of the arch; they are of cast-iron, ¾ of an inch thick, and some over six feet long having the cross-piece thereon 1½ inches thick, standing out ¾ of an inch on each side. The cross-pieces do not extend the whole length, but stop off 2½ inches short of each end, to leave flat places to fit on, and bolt up against the ends of the furnace. The fire-brick for the cap may be ordered from the brickmakers, made to any reasonable pattern that may be required, and are furnished by some at the same rate per pound that they charge for tile. There are two patterns, one for the side and the other for the top. Those on the sides have a recess to receive the cross-piece, which is designed for their support. The side bricks, being supported principally by this rest, it is necessary to make the keystone only of sufficient wedge power to keep it from dropping, its function of holding back the side pieces against their abutments requiring but little. The greater the angle the less the wedge power, and, consequently, the less out-pressing will the side bars have to sustain. This is a point to be looked to, and if there are any indications of the sides spreading they may be tied together by bolts,

which may be shielded from the heat by being let in between the bricks of the top. By this arrangement of the capping, it will be seen that a straight aperture of equal width may be had as long and narrow as circumstances may require the mouth to be, and that a similar opening, wider or narrower, may be made on the back side to let the work pass through, and receive the heat at any point.

The feed boxes can be worked to supply fuel two feet from each end, but it is usual to do most of the feeding through the mouth. It can be used like a bolt furnace with a mouth-piece. When so used, only one or two of the wind-boxes are employed, and those at whichever end is most convenient. In such cases the fire is fed from the feed-box. As the brick of the mouth is much hotter than the iron of a water front, the mouth-piece must be made of something better able to resist heat than cast-iron; it can be made of pounded fire-brick, rammed in a mould of the proper shape, around iron pins, which, being withdrawn, leave the holes for putting in the pieces which it is designed to heat Before ramming the crushed fire-brick it should be slightly moistened with clay water, and this should be thoroughly dried out before the pieces are exposed to a red heat.

The object of having separate wind-boxes, with special valves to each, is to bring every part of the fire under the perfect control of the operator. In the management of long fires, which have but one wind-box, there is found to be much difficulty in keeping a uniform temperature throughout; as soon as there is a place through which the wind can go, easier than through another, it makes such a rush for it that it clears it out still more, and the fire gets more and more uneven, but with this arrangement of wind-boxes and valves, the operator has it in his power to check such a tendency as soon as it is observed; he has but to stop off a portion of the blast from the box which is making the hottest fire; or, if that is not too hot, he can open the valves to those which are delinquent, and so regulate them all as to make the fire as hot in one place as in another. It sometimes happens that the cinder bridges over one of the grates and the blast, coming through that wind-box, spends itself on either side. As soon as this is discovered, that grate can be lowered, the bridge broken down, the cinder cut out, the grate raised again, the live coals on either side tumbled down, new fuel added, and in a short time the fire is again ready for use.

In any case where the full capacity of the furnace is not required, any number of the wind-boxes may be used together, or two different jobs may be done at the same furnace, each man managing the section he controls, as his needs require.

The feed-boxes may be taken off from the ends, and long bars may be heated the whole length of the furnace, by being thrust through the doorways in the ends. There are hinges on each of the ends, not shown in the figure, and doors are kept, which may be hung on these, to close the openings when it is desired to use the furnace in this manner.

Furnaces, on the general plan of this, may be constructed of any length that may be desired, the sides being kept from sagging down with the weight, by the application of truss rods or overhead supports; and from spreading sidewise, by the tie bolts, of which mention has already been made.

An excellent thing about this furnace is its adaptation to the purpose of heating small pieces, which cannot be heated conveniently by laying them on the coals, on account of their liability to drop down between them and get burnt. To do this kind of work, the second, third and fourth grates are bricked over for a hearth, and fires are made in the first and fifth; that is, in those at the ends. The mouth over these two is closed, and the fuel fed from the feed-boxes. The back aperture is closed, except enough to let the products of combustion pass into the flue. This can all be done in an hour, and it is then a double-fired reverberatory furnace. The flames rise up from the fire on each side, float along the vault beneath the arch, concentrate in the center before they pass into the flue, and throw the heat down upon the hearth where the work is laid, and heat it with a safety and uniformity which, when the fires are burning brightly, is nearly equal to that insured by a muffle.

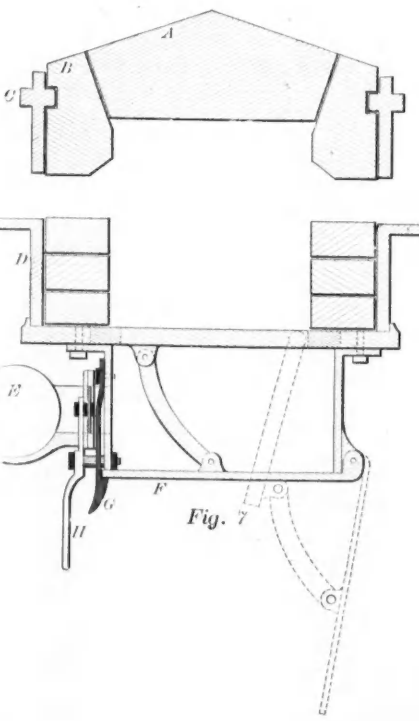


Fig. 7

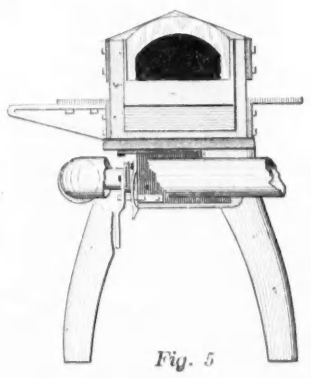


Fig. 5

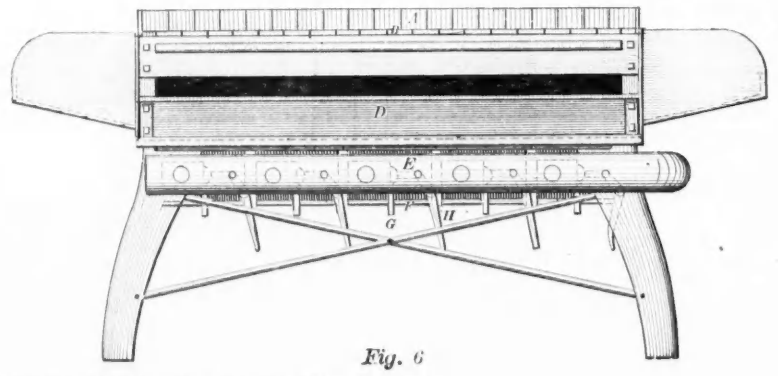


Fig. 6

Details of Blacksmithing.—See Page 1.

A Year of Disaster.

Judged by the record of its first six months, the year 1889 bids fair to be remembered as the year of disaster all over the world. During the month of January there were no serious railroad wrecks except the collision on the New York, Pennsylvania & Ohio Railroad, in which eight persons were killed, and as many more seriously injured; but there were fifteen marine disasters, involving a loss of 165 lives, included among them being the steamboat Paris C. Brown, which went down in the Mississippi river, costing the loss of 11 lives. February and March also were singularly free from railroad disasters, but the marine losses in February were 284, an increase of 119 over January. During the same month 20 persons lost their lives by a railroad disaster in Belgium, 10 by a wind-storm in Nebraska, 23 by the terrible hotel fire in Hartford, Conn., 200 by an earthquake in Costa Rica, 13 by a cyclone in Georgia, and 11 by a powder explosion in Wilkesbarre, Pa. In March the marine losses further increased to 351, the number being swelled by the 146 sailors of the German and American war vessels who were drowned during the hurricane at the Samoan Islands.

In May the floods began their work of death and devastation. The first intelligence came from Austria and Bohemia, where 135 lives were lost. The consummation was in the Conemaugh valley on the last day of the month, when nearly 5,000 persons perished and $10,000,000 worth of property was destroyed. The month was characterized by a frightful series of disasters. Thirty persons were killed by an accident on the Pennsylvania road at Latrobe; 70 by a railroad disaster at Armagh, Ireland; 1,200 by a fire in China; 40 by a falling market building in Mexico; 70 by a mine disaster in Austria; and 70 by a cyclone in Cuba. July well keeps up the record with railroad, mine and storm disasters. Altogether, during the first six months of the year, nearly 15,000 lives were lost in disasters of all kinds. Besides the loss of property involved in these disasters, fire has swept away property amounting to over $70,000,000 in value in the United States. It adds to the mournful record of the six months, that suicides, murders, hangings, lynchings, and crimes of all kinds have also shown a marked increase over the corresponding period for many years past.—*Chicago Tribune.*

Foundry Ladles.

By Robert E. Masters.

Ladles in a foundry have considerable influence on the men who are employed to use them. I have known first-class moulders to quit a place on account of the ill-shaped—hard to-handle, kill-a-man style of ladles used. Mr. L. C. Jewett, a well-known practical moulder and superintendent, once wrote the following concerning himself on this subject in the American Machinist:

"In a shop where I had just started to work, my first cast was to be made; I inquired for a single hand ladle; the foreman, after a prolonged search, brought forth a round bottom cast-iron pot, which had been in service as a hand ladle for about two years. This pot, when filled, would hold about seventy-five pounds, and the foreman said: 'You are not obliged to fill it.' This so-called ladle was not filled by the writer, neither did he remain to see another heat in that foundry."

Seventy-five pounds of iron is too much to carry in a hand ladle; it may be all right occasionally, but if a man makes a regular business of pouring off a big floor with a ladle that holds that much iron, it will break him down. Yet I have known moulders so anxious to pour a certain number of moulds each "dip" and "get-off," that they would mould a new hand ladle, and after drawing the pattern punch down around the edge with a thin stick, and make the casting an inch or so deeper than the pattern, and use that, carrying it brim full; it would be better to make a few more trips, and not carry so much at a time.

Hand ladles were originally designed for pouring very light work (and feeding up risers on heavier work), and a half dozen or less forty to sixty pound ladles would pour off a floor; but I have seen men so completely fagged out by carrying twenty-five to forty pound ladles the whole length of a shop, to pour fair-sized machinery castings, that they would hardly recover enough to justify them in going to work the next morning. This can be avoided by furnishing small, double-shank ladles, and if there is any objection to pouring the moulds with these "pony" ladles, send a couple of "bull" ladles to the floor, and help the man out by pouring it into the hand ladle. I have never seen the time that I could not spare enough laborers to carry the iron to a man who had so much to pour.

The following table of the sizes of ladles is given on the old standard rule, that the inside top diameter agrees (or nearly so) with the depth. The capacity is given in round numbers.

Inside diameter of ladle at bottom without lining.	Inside diameter of ladle at top without lining.	Height of ladle, inside measure, without lining.	Thickness of bottom lining.	Thickness of side lining.	Depth of space allowed from surface of fluid iron to the top edge of ladle for the sway or motion of metal when handling.	Capacity of ladle when lined up—and the motion space allowed.	Style of ladle.
5¾″	6¾″	6¾″	¼″	¼″	½″	40	Hand
6½″	7½″	8″	¼″	¼″	¾″	60	
8¼″	9¼″	9½″	½″	⅜″	1″	100	Pony
9¼″	10½″	10½″	½″	⅜″	1″	150	
10½″	11½″	11¾″	¾″	½″	1″	200	Bull
12″	13″	13¼″	¾″	½″	1¼″	300	
14½″	15½″	15½″	1″	¾″	1¼″	500	
15″	16½″	16½″	1″	¾″	1¼″	600	
16¾″	18″	18″	1″	¾″	1¼″	800	
18″	19½″	19½″	1″	¾″	1½″	1,000	Crane or Receiving.
19″	20½″	20½″	1″	¾″	1½″	1,200	
20″	22¼″	22¼″	1¼″	¾″	1½″	1,500	
22¼″	24½″	24½″	1½″	1″	1½″	2,000	
23¼″	26″	26″	1½″	1″	1½″	2,400	
25″	27¾″	27¾″	1½″	1″	1½″	3,000	
26½″	29¾″	29¾″	1½″	1¼″	1½″	3,600	
27¼″	31″	31″	1½″	1¼″	1½″	4,000	
29½″	33½″	33½″	1¾″	1½″	2″	5,000	
31⅛″	35½″	35½″	1¾″	1½″	2″	6,000	
35″	39½″	39½″	2″	2″	2″	8,000	
37¾″	42½″	42½″	2½″	2″	2½″	10,000	
40¼″	46″	46″	3″	2½″	2½″	12,000	
44½″	50¼″	50¼″	3½″	2½″	3″	16,000	
48½″	54½″	54½″	4″	3″	3″	20,000	

No one will be expected to line a ladle just the same thickness all the way up the sides; for instance, the 1,000 pound ladle will be lined heavier around the shoulder at the bottom, and taper off thinner towards the top, but will average ¾″; some may line their ladles thinner than the figures in the table, but I have given a lining that will be safe if any of the ladles are used for receiving the iron from the cupola, and have to stand the heat for hours.

If a 500 to a 2,400 pound ladle is used "to tap into," and pour from that to the smaller ladles, a lining of clay and sand, mixed in proportions so it will not crack too much, and a few thin fire-brick on the side that will be opposite the cupola spout where the stream strikes it when a full head is on, makes it safe, and keeps it from cutting through. If any of these sizes are to be used as crane ladles, the fire-brick can be omitted.

The 3,000 to 5,000 pound ladles, as receivers, ought to have a light, fire-brick bottom, with a good coating of clay daubing, and fire-brick on a portion of one side, as mentioned above. For using the ladles themselves for pouring moulds, the fire-brick can be left out entirely.

Ladles holding from 6,000 to 10,000 pounds of iron should be lined with fire-brick in the bottom and all around the sides, nearly as high up as the band on the ladle, and finished with clay daubing. The last three sizes in the table should have fire-brick of suitable thickness in the bottom, and all the way to the top on the sides. Where a "cut through" from the iron would result in such a large loss, even if no one was burned, it is false economy to trust to a clay daubing alone, no matter how well it is put on and dried; any one feels safer when they have to stand around a ladle containing such a quantity of fluid iron, when they know it is well lined with fire-brick.

Charcoal is the best fuel to use to dry the daubing, but the majority of foundries use wood. To do the work thoroughly in a

newly daubed ladle, a light fire ought to be made and built up until the daubing is well set; the ashes settling in the bottom keep it from drying out as completely as the sides. The ladle should then be cleaned out, and the blisters (if there are any in the daubing) doctored, and the cracks well stopped up; then put the hot coals from the first fire in the ladle, and fire up until it is completely dried. The larger ladles should have a coat of black wash over the daubing.

It sometimes puts a foundryman in a bad predicament to have the iron bubble and boil all over from an imperfectly dried ladle. This can be prevented by pouring a little iron in the bottom of the new ladle at the first of the heat, if there is any doubt of its having any moisture. Any moisture in the daubing is made into steam when the fluid iron comes in contact with it, and if it cannot escape through the bottom it is bound to come up through the iron. Besides this, there is the risk of the daubing blistering and coming off. For this reason ladles ought to have a number of small vent holes around the bottom. When there are no vent holes, pieces of tarred or heavy twine may be laid across the bottom and up the sides, letting them hang over the edge of the ladle, and work the fire-brick or daubing over the twine; by the time it is filled with iron the lining will be well vented, and will not bulge or blister in the bottom.

Every foundryman knows what a tough job it is to get the old lining out of very large (and especially straight) ladles. When the old lining has been used for the last time, and while it is still red hot, turn a stream of water from the hose into it; it will splutter and boil, and snap, and crack, but keep the water in until the lining is about warm enough to evaporate what water is in the ladle, and dry itself out; it will then come out much easier.

Motion Reducer for Steam Engine Indicator.

BY A. B. LANDIS.

Numerous devices have been illustrated and described for reducing motion for steam engine indicators. The one herewith illustrated is different from any I have heretofore seen, and presents some advantages over others, in that it can be attached and detached from the engine while the engine is in motion (that is the entire device), having means by which the attachment can be made to the crosshead while the engine is running, even in engines of the high-speed class. The motion reducer, as here shown, is designed to be attached to the side, or Corliss bed, as will be seen. Slight modifications, however, will adapt it to any type of engine.

The device consists of a column *A*, mounted on top of the bed of the engine by a few bolts, which are withdrawn when wanting to remove the same; the top of this column is bored to form a bearing for the pipe *G*, and a receptacle for the spring *J* (shown in Fig. 2). Upon one end of the shaft *G* is mounted the segment *B*, which has upon its periphery a groove for the reception of the cord *F*, which cord passes through a hole at the end of the segment. This segment should be made as light as possible—steel preferred. On the other end of the shaft is mounted the small segment *C*, which must be made in proportional size with the large segment as the motion of the crosshead is to the indicator. To this segment is attached the cord *E*, passing to the indicator. This cord also passes through the hole, as shown at *I*, Fig. 2, and passes to the center of the shaft *G*, and thence through hole through the entire length of this shaft. This is for the purpose of starting and stopping the indicator after taking a card.

A knot in the cord *E* comes in contact at the hole *I*, and thus always gives the same length to the cord when pulling at it from the front through the shaft *G*. A spring *J* coiled around the shaft is fastened at one end into the solid collar shown at the other end, and fastens to the collar *K*. This collar is turned by a pin in the hole *L*, for the purpose of winding the spring to a proper tension, to throw the segment *B* back, and keep the cord *F* taut under all conditions. The collar *K* is held in position by the set screw *N*; the shaft rotates in this collar.

The cord *F* is attached to a lug or pin *D*, shown enlarged in Fig. 3. The end of the cord *F* has a handle *H* coned slightly where it engages the pin, so as to be readily retained therein. A slot *M*, in this pin, allows of the free engagement of the cord while the engine is running. The dotted position of the cord will show the manner of engaging it. Take hold of the handle *H*, and draw the segment back against the spring, and a little beyond the limit of the crosshead movement; press the cord down so the slot *M* slides back and forth over the cord; now, by holding the handle *H* so the pin or lug just touches it, and letting go of the same at that instant, the rig is started. By grasping the handle, just as the crosshead is reversing, the cord can be lifted out of the slot, and thus stop the motion.

When through taking cards, the whole is quickly removed and set away, leaving nothing but the stud *D*, which is barely noticeable. For an engine from which cards are to be frequently taken, this makes a very desirable device, as the one I made and put into use fully demonstrates.

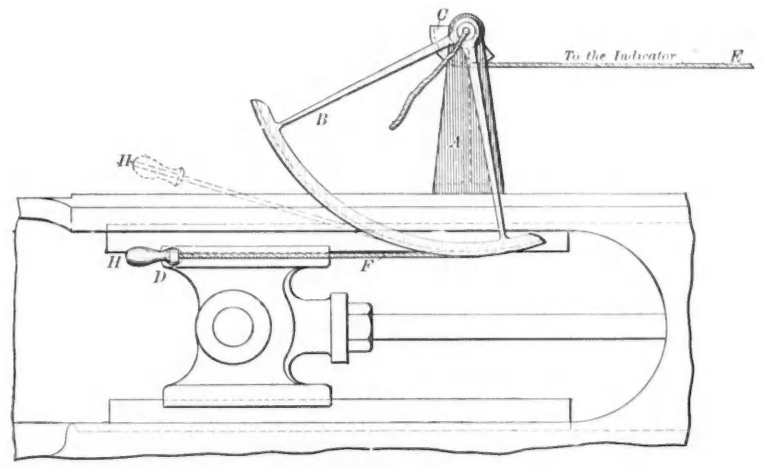


Fig. 1

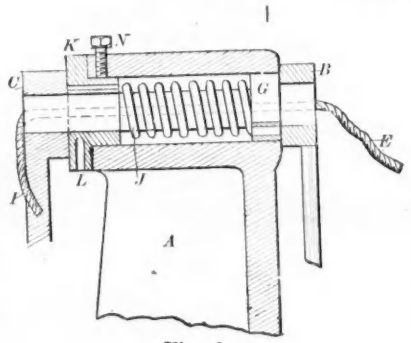


Fig. 2

MOTION REDUCER.

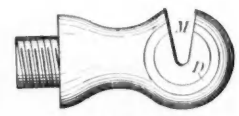


Fig. 3

The Lancashire & Yorkshire Railway Shops.

The Lancashire & Yorkshire Railway Company shops, at Horwich, England, are fine examples of modern English practice in the mechanical department of railroading. Having been recently built—they are hardly completed yet—they embrace what is considered best in such practice, which contemplates the production from the raw material of nearly everything required. In these shops, which have a roofage of fourteen acres, 2,500 men are employed, under the direction of chief engineer Aspinall.

The shops are built on forty-five acres of ground, and are of the most substantial character, and excellently well arranged for turning out work at low cost. Advantage is taken of the grade of the ground to bring gravity as much into play as possible. The crane system is very complete, and the entire arrangement has been schemed with a view to keep all work moving ahead to the point of final assemblage in the form of the machine, or to where it is most conveniently shipped to the places on the roads where it is required for use.

Gas is used for fuel wherever it is practicable to do so, and the gas producers are so located that the coal comes in at an upper level, and the refuse goes out at a lower level, no elevating of either being required. The same is true of the cupolas for both steel and iron, the fuel and material requiring no handling except feeding in at the top, the moulding floors being on the level at which the castings are required. This, where so much metal is cast daily, amounts to a considerable saving of labor.

The arrangement of the shops is in "bays," a common form of construction in England, these bays being covered by traveling cranes. Altogether the minimum amount of handling of work is required, and the most convenient means for doing what handling is necessary is provided.

Special tools are largely employed for machinery work. The number of planers is few—a large amount of the work usually done on planers being done on milling machines, both common and special. We saw large surfaces—iron and steel—being machined by milling, that were remarkably smooth, saving a good deal of time in finishing, over work as ordinarily done by planing. Side frames are finished on their edges by slotting several together.

The cylinders are cast together, one head being cast in. They are first planed up, then go to a jig, and the four stuffing boxes are bored out; then on another jig they are bored for the pistons.

Steel castings are quite extensively used, all driving wheels being made of this material. The wheels, as well as other steel castings, appear to be quite sound, and the successful use of this metal for wheels, crossheads and other heavy parts, saves a good deal in cost, as English practice does not permit the use of cast-iron for such purposes. These castings are, as is necessary with steel, cast with large risers, which are cut off with cold saws, a practice that American manufacturers would do well to look into more. A great deal of time is saved by the use of these saws.

In the iron foundry from sixty to seventy tons of castings are made each day, the average weight of a casting being about one hundred pounds. Besides these there are the steel castings and the chairs. Mr. Aspinall informed us that the problem in arranging for making chairs was to do all the work for fifteen shillings (about $3.60) per ton—2,240 pounds—as they could be bought at a price corresponding to that. This price includes the interest on investment and maintenance of plant. The chairs are made in a separate foundry, and, notwithstanding the remarkably low figure, are made at a profit. The moulds are made, other men follow after, pouring them, and still others follow, shaking out. Then the castings are passed to the cleaning floor, and from there into cars. Two men work at a mould, one at the cope and the other at the nowel, and the two will put up three moulds—setting the cores—ready for pouring, in one minute. The castings will weigh—at an estimate—twenty to twenty-five pounds. Making these castings is the quickest work I saw done in England. Only one tool is used by the moulder—a combination of shovel and rammer.

A mercury column is used for testing gauges, and it is so arranged that, when the limit of pressure is reached, an electrical connection is made, which rings a bell. Other readings are taken from a test gauge that is corrected by the mercury column. The electrical department of the works is very complete, quite a number of men being employed on the apparatus necessary for railroad operation.

We noticed at the works a machine for making nuts that was peculiar in its operation, in that it wasted no stock. The nut was formed on the end of a round rod, about the diameter of the hole required. The machine upset the rod and formed the nut, the last operation being to punch the rod out of the nut, the latter falling down completed. The machine is ingenious, but the operation of making nuts in this way is not as rapid as by other means we have seen.

An ingenious machine is used for grinding holes in bushes located in rods or pieces that it is not practicable to swing, and where it is not desirable to remove the bush for truing up the hole. A vertical spindle carries a small wheel; this spindle is journaled in an eccentric spindle, and this last spindle is fitted in another eccentric spindle. Means are provided for revolving the first eccentric spindle in the second, and locking them at any desired relative positions, one to the other. It will be seen that by this means any required eccentricity within the range can be given to the axis of the emery wheel. In operation the emery wheel spindle is given the desired speed, and the outer and inner eccentric spindle revolve slowly together, sweeping the emery wheel around on the circle desired. The eccentricity can be changed when the wheel is in motion, operating to increase the diameter as the surface is ground away, just as a wheel would be fed up to the work if the bush was revolved in a lathe or grinding machine. It would appear as though various uses might be found for such a tool.

Bronze valves are used on locomotives, and these are cast so as to require no machining except upon the face, which is done by grinding.

The Joy valve gear is the standard, and it is well schemed for motion, and large bearing surface is provided for the pins. We understand that it gives good satisfaction.

Mr. Aspinall is, we believe, the youngest engineer in England in charge of the mechanical department of a large railway, and he has built, up at Horwich, one of the finest plants of the kind in the country. The reception-room and offices are models in their way, and system prevails throughout every department. In the department of tests a large amount of useful work is done. Very fine testing machines are in use, and tested specimens are kept for future reference.

The standard mill shaft in Lancashire, England, has enlarged ends for the couplings, these ends being so large that the keyways are not cut so deep as to reach the body of the shaft. The ends are got out, roughed and welded to the ends of a length of shafting, which is afterwards turned up. The enlarged ends demand the use of split pulleys, which is probably a good thing. But these ends multiply the cost of the shafting. If split pulleys were used, thereby avoiding the necessity for removing couplings, it appears as if they could be put on shafts without enlarged ends, so that there would be no danger of a failure to hold. This is only an outside view of the matter; if Lancashire mill owners prefer to pay the cost of enlarged ends, it is their own business.

In many large steam engine manufacturing establishments in England, the practice is to bore the hubs of large rope driving wheels larger than the shaft, and hang them on keys—an old millwright practice in this country. This insures getting the wheels to run true, which is not always an easy thing to do in the instance of wheels from thirty to forty feet in diameter, bored to fit the shaft.

New Upright Drill Press.

It is the common practice where a foot-treadle is used for producing the feed motion of a drill press, to attach it by suitable connections to a vertical slide under the table, which is thus moved up or down to obtain the feed.

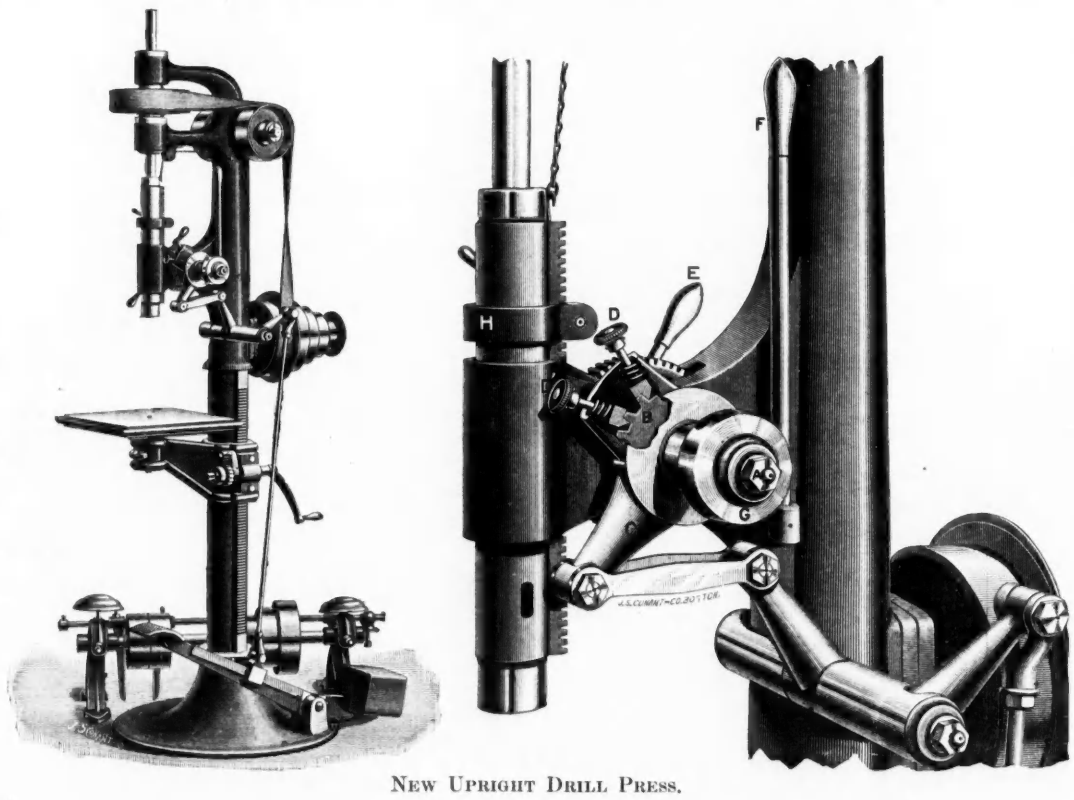
In the press which we illustrate herewith, though a foot-treadle is used, the table is not moved in feeding, but by suitable connections the spindle is moved up or down by the treadle.

The method of connecting them is shown in Fig. 1, while the ratchet mechanism is shown on a larger scale in Fig. 2, where B is the ratchet wheel, and D, D', two pawls working in opposite directions, and held in engagement by the small spiral springs shown. When both these pawls are engaged, as shown in Fig. 2, the spindle is moved up or down by the motion of the treadle, the maximum up and down movement being $3\frac{1}{2}$ inches.

The amount of this motion is varied, however, by changing the point of connection on the foot-lever, which can be done to suit the varying requirements of the work as to power of feeding. When it is desired to drill a hole deeper than can be drilled at one movement of the lever, the pawl D' is withdrawn, the other one, when the foot-treadle is allowed to rise, slipping over the teeth, and taking hold again. This can of course be repeated until the hole is drilled to a depth equaling the full movement of the spindle, which is 11 inches.

When it is desired, a hand lever can be used for feeding in place of the treadle, or they may be used together. In the engravings, this lever is shown in a socket provided for it when not in use at the side of the frame. There is a disk keyed to the outer end of the feed-shaft, which has holes drilled in it for the insertion of the lever when it is desired to use it. The spindle also has the usual quick return movement. The foot lever and its connections are properly counterbalanced, as is also the spindle. The sleeve which drives the spindle, and to which the driving pulley is attached, runs in two composition bearings, $1\frac{5}{16}''$ diameter, $3\frac{1}{4}''$ long, and it has been the special aim to secure ample bearing surface at all working parts.

Either a square or round table is furnished, the former being 14″ square, the latter 15″ diameter. The table is raised and lowered by rack and pinion movement, and has a $\frac{3}{4}''$ reamed hole for the reception of a center, which may be brought into line with the spindle by means of lines drawn on the rack and bed-piece. The height of the machine is six feet; diameter of base, 24″; diameter of column, $4\frac{1}{2}''$; diameter of spindle, $1\frac{1}{8}''$; extreme vertical movement of table, $21\frac{1}{2}''$; greatest distance between spindle and table, 29″. The hole in the spindle fits the No. 2 Morse taper shank, and holes can be drilled up to $\frac{5}{8}''$ diameter. The weight of the machine and countershaft is 600 pounds. The builders are Luscomb & Corey, New Bedford, Mass.



New Upright Drill Press.

Literary people who in their writings refer to mechanical or technical matters, almost invariably make some ridiculous blunder which reveals their entire lack of familiarity with such matters. A notable exception to this is found in the excellent story of John R. Spears, in the current number of *Scribner's Magazine*, entitled "The Story of a Lost Car." It deals with railroad matters, and is strikingly true to life, showing that the author either has had practical experience in railroading, or has been at great pains to secure accuracy and avoid error. The high and lofty manner of the superintendent in indefinitely suspending the engineer and conductor of the wrecked train, upon the merest shadow of a suspicion that they may have known something of the lost silver, entirely ignoring their previous long and faithful service, and even their excellent conduct at the time of the wreck, will be recognized by every railroad man as an especially well-written passage, and the story is full of them.

Exposition Notes.

(Editorial Correspondence.)

The reception and entertainment of the American engineers by the Société des Ingénieurs Civils, of France, was cordial in every sense of the word. Distinguished members of the French Society met the party at Calais, and accompanied it to Paris, where the rooms of the Société, both on and outside the Exposition grounds, were thrown open to the use of the Americans. During their stay, as a body they were dined, and shown about Paris till they were glad to cry enough. Numerous places of interest were visited, and work went on early and late. Every American engineer who participated in the festivities and entertainments at Paris will have warm feelings towards the Société des Ingénieurs Civils.

It is impossible to refer to all the entertainments, so, as in the case of the reception in England, they must nearly all remain unmentioned. If one, however, more than another deserves mention, it is the visit to Eiffel Tower. The American engineers were taken from the bottom to the top of the tower, and were accorded privileges that were not accorded to the general public, in being permitted to ascend, by means of the stairs, from the upper platform into the region of the surmounting lantern. Returning, there was a dinner at the restaurant Brebant, on the lower platform.

Here I want to go on record as entering a protest against all the pictures and models I have so far seen of the Eiffel Tower, either in New York or Paris. They are simply caricatures of one of the most beautiful engineering works ever seen. Viewed either critically, near by, or from a distance, the proportions are such as please the eye, and excite admiration. Until some one develops genius enough to produce a picture or model that will appear to the eye something as the tower appears, the making and selling of them ought to be interdicted. A draftsman who has made a drawing of a two-hundred foot chimney, on a scale of one-eighth of an inch to the foot, and then wondered why the chimney, when built, did not look like his drawing, will have some idea of the difficulty in the way of making a satisfactory model of a tower 1,000 feet in height. It must be made to the eye, not to measure. Mr. Eiffel saw how the top of this tower would look a thousand feet in the air, and not how a correct representation of it, to scale, on a little piece of paper, would look; otherwise he could not have produced the effect he has produced. The stuffy little pictures and models ought to be suppressed, on the ground that their tendency is to teach false engineering doctrine.

The luminous fountains on the Exposition grounds—fountains that emit by night great streams of water of all the colors of the rainbow—are a never-ending source of pleasure to visitors, and many engineers were glad of the privilege accorded them of examining the mechanical appliances by which the effect is produced. To make this examination a descent was made, accompanied by the engineer who constructed the work, into the spacious regions below the fountains. I believe the inventor—if that is the proper word to use—of colored fountains was a Swiss engineer. The theory is very simple, being nothing but the projecting of strong rays of light through colored glass into the water. But to carry it out so as to produce the desired effect requires the exercise of a good deal of skill and ingenuity. For example, a stream is projected horizontally; by means of heavy, colorless plate glass over the end of a suitably shaped fitting to the pipe—like an elbow—light can be projected from a lens through a colored plate into the water, giving a most intense color; but as the stream of water changes its direction in obedience to gravity, the rays of light will continue in straight lines and pass out through the water, the effect being lost thereafter. To overcome this, the water is projected in the form of an annular ring, and the light is projected into the enclosed central space. It appears that the projected rays of light, like most other things, are inclined to follow the paths of least resistance, and it also appears that if the annulus of water does not maintain that form as it curves downward, it does maintain a condition of less density at the center, and the light curves downward with it, being imprisoned, as it were, by the denser water at the circumference of the jet. I only mention the horizontal jet as one instance of overcoming difficulties in the way of accomplishing the end. The direction of the light has frequently to be changed before it strikes the water, the effect of counter lights of different colors is produced; in fact, the mechanical arrangement requisite, or possible, is unlimited. The same color is not maintained in a jet, but is changed at frequent intervals. This is accomplished by changing the plates of colored glass, and this is done by small levers on a switchboard, very like in miniature those used on railroads. The effect of these changes in a large number of jets is most beautiful; if one understood the music of colors it would be possible to discourse liquid music with these fountains.

The Exposition is, as Expositions are rated, an enormous affair. It could swallow about a half dozen of our own Centennial without effort. That it is a thing of "magnificent distances" one is likely to realize before he has traversed more than a small portion of the ground covered. As more than one has given expression to, it is too large. It is, so to speak, unwieldy. One need never expect to see more than a part of it.

In the construction of the Exposition buildings, French architects and engineers have done themselves infinite credit, vast sums of money have been expended, and the expenditure appears to excellent advantage, so far as producing the desired effect is concerned. Machinery Hall, with a clear span of 375 feet and a length of nearly 1,400 feet, is something never before attempted in architecture. This building is likely to remain standing when the others give place to other needs.

The manner in which tickets are sold shows the difference in practice in different countries. You are besieged on all sides, and in all parts of the city, to purchase. The number of itinerant venders of tickets must reach the thousands. And the tickets are sold at all manner of prices, according to the knowledge of the purchaser of what he ought to pay. I believe there has been some sort of a wholesale lottery scheme connected with the disposal of tickets, which probably has to do with the number engaged in retailing them. There are little booths established by the management, usually within a block or two of an entrance gate, but I never saw one of them patronized. Outside competition is too great, and I believe you can buy tickets from the itinerant venders at a less price than at the regular booths, though a stranger is likely to pay more. Then again the price of tickets varies from day to day, just like the price of stocks on Wall street. Sometimes the Bulls have the best of it, then the Bears prevail. Sometimes it requires two tickets to get in, sometimes one will pass you, that is at different times in the day. And so far as I can see, the authorized booths are entitled to sell at such prices as they can get. However, the price of admission is low enough, even if things are so jumbled that no one knows just what he is to pay.

The first thing one is likely to do is to take a general survey of such of the exhibits as he is most interested in—make a reconnoissance as it were, before beginning the battle. In doing this, an American is apt to come to the conclusion that there is a good deal of excellent machine work being done outside the United States. There are engines of the Corliss type upon which the workmanship is better than I have before seen, and there are exhibits of machine tools that show excellent design, and workmanship better than American builders have yet put into such tools. At previous international exhibits, Americans have prided themselves upon the superior design, finish, and general workmanship of American machinery. But European builders have, apparently, learned a lesson from these Expositions, and it appears that they see their way to putting more work and better material into the same kind of tools than American manufacturers; at least in many instances they are doing it. Whether or not it would pay to do such work in the United States is a question that manufacturers must settle. But we are not likely hereafter to sell machine tools and steam engines in Europe to any great extent because of better workmanship and finish. American manufacturers will doubtless recognize this fact, and profit by the knowledge. How much of this is due to cheaper material and labor, I am unable to say. Material is undoubtedly a good deal cheaper, and labor does not cost so much; but, as far as I can ascertain, special machinery is not used so much—not nearly—on the Continent as it is in the United States, and that ought to help to balance the difference in the cost of construction. I mean

special machinery for small machine shop work. Perhaps our machine tool and steam engine work is done well enough; the intention is not to argue that, but to state facts.

It appears to me that we are laying too much stress upon the superior intelligence of American mechanics. The European mechanic is not the stupid fellow he has been pictured as being. I have talked with Alsace and Belgium mechanics, being referred to them because they could, and the exhibitor could not speak English—mechanics engaged in erecting machinery at the Exposition—and found them men of excellent intelligence and having a good deal of knowledge of mechanical matters; all our traditions are against this, but traditions sometimes falsify matters.

There is amongst many Continental builders an inclination to make as large an exhibit as possible, and show as little as they can. They build a fence around their exhibit and around all other sources of information. Many of them appear to think the bottom would drop out of things generally if it were known just what they build. This is not the case with all—in some of the very best exhibits here every opportunity for inspection is offered—but it is nearly universal in the case of finished machinery. On pretty much everything that a looker-on can get near enough to touch is a notice requesting, generally very politely, that it be not handled. It seems to make no difference if it is something that could not be injured with a twenty-pound sledge. I fancy it was the universality of this notice that prompted a well-known American exhibitor—a mechanic who likes to know how things are made, and who shows a good many duplicate parts of his exhibits, to attach a legend, in both French and English, to the effect that those interested could handle as much as pleased them.

American and English exhibitors are usually willing to permit any reasonable inspection of their exhibits, and to furnish any information desired. I have heard of one or two exceptions. One was in the instance of an English exhibitor who had a trappy little twist drill grinder, and his assistant invited an American tool maker, who paused for a minute against the exhibit, to come inside, and the exhibitor would be pleased to show him the machine. But the exhibitor, finding where he was from, refused to show it; he might copy it. The whole contrivance looked to be worth about forty dollars, and the cheapest way to have copied it, had there been any such intention, would have been to have bought one outright for a model. I do not think, however, that that English twist drill grinder will be copied on the American side of the water.

In machinists' tools—squares, standard scales, verniers, micrometers and the like—I have seen nothing that appears to me to be as good as those of American manufacture. These American tools look better, are cleaner cut, and more convenient, to my mind. How they compare as regards precision I cannot tell, but I think they will stand the test in that respect. Neither do taps and reamers and small tools of similar character appear to be as good as those of American manufacture. The grooves are cut shallow, and they have a general appearance of uncertainty, as if the maker were afraid to do what he thought ought to be done.

I have never seen better castings than most of those in the European machinery. Of course it is never safe to assume to what extent such castings have been "doctored" to hide their weak points; but the clean cut corners and regular contour is not a thing of filling and paint. Besides, there are castings in the rough, some of which I shall have occasion to speak of again, and these tell the story of good work in the foundry; also those parts that are finished. In general appearance the castings made on the Continent indicate that the moulder does not use the trowel and sleek as much as the American moulder. Perhaps he has better patterns to work from.

As an example of what can be done in the pattern shop and foundry, a casting by the Society Cockerill is noteworthy. It is of a three-cylinder compound engine, the largest cylinder I should think about three feet in diameter. The cylinders, bed-plate, condenser, air pumps, side pipe and other parts usually cast separately, are all cast in one piece, and the casting is an excellent one at that. Whether the man who was responsible for making the mould, with its multiplicity of cores and parts, side and angle draws—draws in every direction—went crazy over the nightmare of complications, is not stated. Of course this casting is valueless except as it shows what can be done in the foundry. As showing that, it is probably the best success ever seen, and who shall say that in that it is not as valuable as a picture that shows, in the main, the skill of the painter? There is something besides sand and cast-iron in the work of the moulder, just as there is something more than stone and chisels in the work of the sculptor, and I am inclined to honor the firm that went to a good deal of expense to show this. I refer to these things as matters of interest in that they show the state of the art in Europe, and that is something that vitally concerns American manufacturers. In things in which we are ahead as a country let us congratulate ourselves, but it is a bad thing to believe we excel where we do not. As a matter of fact our foundry work will bear revising.

In steel castings, Europe appears to be ahead of us, in the matter of producing sound work. As to their strength I cannot speak from personal knowledge. It is almost impossible to get any reliable data. I have seen castings in steel free from shrinkage imperfections that would seem very difficult to make, and some very excellent examples of cast steel gears. Still, these castings are not as extensively used as one would think they would be. Just as they preferred forged iron for many parts of machines where we used cast-iron, so now they seem to prefer steel forgings to steel castings.

In forgings there are some excellent examples, particularly in the line of heavy work, such as we have hardly reached. A French firm shows some large marine engine crank-shafts, a forged section, with crank and coupling, lying close beside a finished section. It is evident they believe in forging close to finished sizes. More waste will frequently be seen on a piece one-quarter the size. A moderately small forked connecting rod is also an example of good workmanship. Fac-similes of steel blooms for heavy guns are shown. One of these blooms weighed more than 220,000 lbs.; another more than 180,000 lbs.

Immense forgings for steel guns are shown, ponderous tubes, finished and unfinished; steel forged and then hammered and twisted cold into all shapes, steel castings finished to show their soundness; in fact, almost everything to show the quality of the metal is shown by French forges and steel works.

In copper work there are seamless tubes nearly 37 feet in length and about 27 inches diameter; also some much shorter in diameter, but not so long. Copper is shown worked into all shapes; for boiler heads, furnaces, a complete boiler, immense goblets, and an immense variety of forms, useful and ornamental. There are also some very fine brass rods six to eight inches diameter, and thirty feet long; also a fine casting, in bronze, of a spur wheel about five inches pitch and weighing more than 3,500 lbs.

There is a perfect wilderness of agricultural machinery, and the most of it is very neat in design. It looks rather light for service in the rough fields of America, but it is perhaps strong enough for the smoother and more highly cultivated grounds of Europe. If the time has been when Europeans have built clumsy agricultural machinery, that time has evidently gone by. It will not be easy to beat their designs so far as looks are concerned.

In portable farm engines, as in agricultural machinery, the design is very neat and the construction appears to be good, but the running gear looks as though a day or two over rough American roads and land would send the whole thing to the scrap heap. But assuming, which we must do, that the builders know the conditions under which their machinery must work, they have produced some very creditable work in the way of farm machinery. There is nothing, however, in harvesting machinery that is likely to be considered equal to that made in America, which has always stood at the head.

In wood-working machinery I think we excel, at the Exposition. Our machinery appears to do more and better work, and to do it more completely; that is, it leaves less work to be done by hand. The different machines also have more the appearance of having been worked up to the condition of complete *machines*, rather than being an aggregation of somewhat irresponsible parts. Of this as well as other exhibits I hope to find more to say in detail in a later issue. H.

Shafting Grinder.

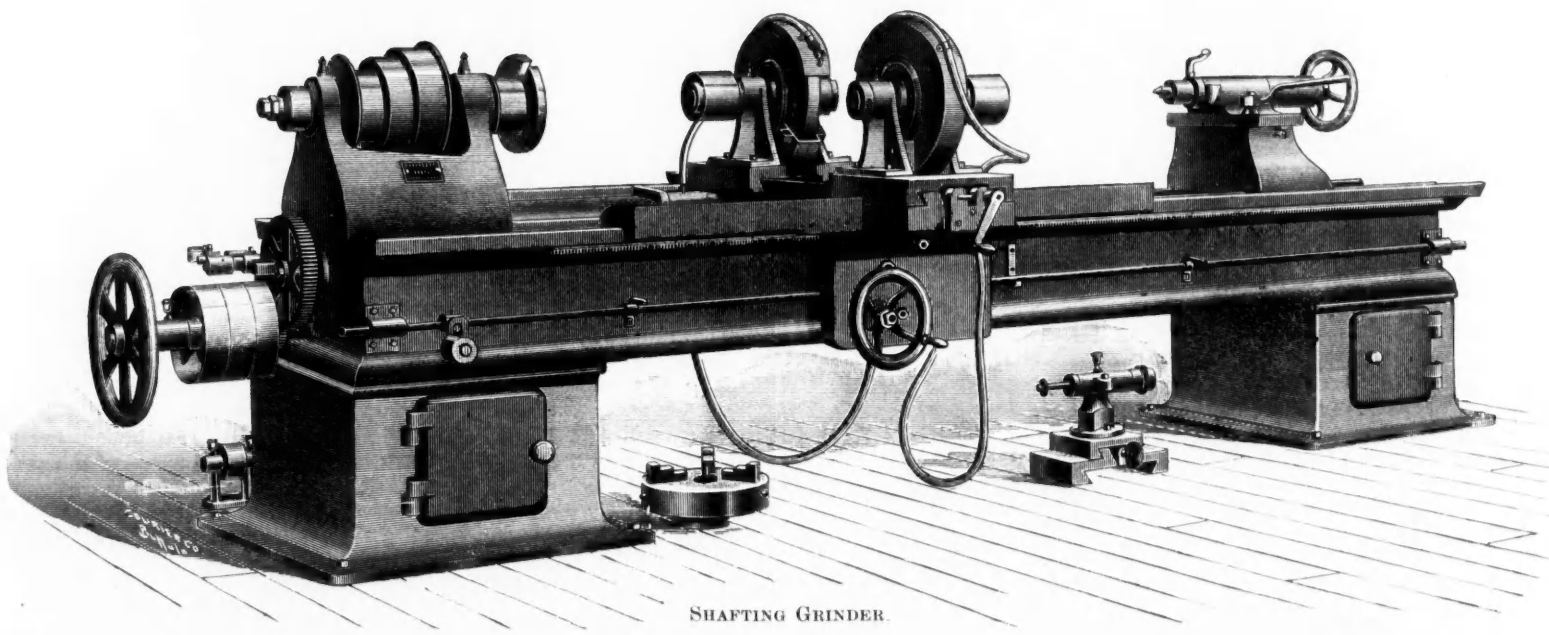
We illustrate on this page a machine for grinding cylindrical or tapering work, either on centers or when held in a chuck.

It is so constructed as to swing heavy work, the bed being supported upon hollow pedestals, forming closets for the reception of small tools and fixtures, and the bed being closed up at the bottom, to form a trough or reservoir for holding water which is forced in a stream onto the work by a pump, which is part of the machine. This liberal supply of water prevents heating and expansion of the work, greatly facilitating the grinding, and enabling more accurate work to be done than would otherwise be possible.

The carriage carries two emery wheels, and is fed back and forth over the bed by a lead screw, which passes through under its center and is connected by a split nut, which can be open and shut the same as on a lathe. The carriage can also be moved by hand, the same as a lathe carriage.

The machine is furnished with only one wheel when desired, in which case a steady rest is furnished. An extra head is furnished to run on the carriage, which carries a small wheel for grinding the inside of wheels or other work held in the chuck on the spindle, and such holes can be ground straight or tapering. The feed work and slide of the machine are covered and fully protected from emery and dust.

The motion of the carriage is automatically reversed by means of adjustable tappets on a rod, which is in front of the bed.



Shafting Grinder.

The bed is twelve feet long, and work eight feet long, 22″ diameter, can be swung on the centers and over the carriage. Emery wheels from 14″ to 20″ diameter can be used. The bearings of the emery wheel spindles are 2″ diameter, 4″ long, the main spindle being 2½″ diameter, with bearings, 6″ and 4½″ long.

The machine is built by the Springfield Glue and Emery Wheel Co., Springfield, Mass.

It seems to be a well-established opinion in England that what is worth doing at all is worth doing well. In the great cotton district of Lancashire the mills have the appearance of being built for future generations as well as for the present. Mills with stone floors throughout, with corresponding construction in other respects, convey an idea of permanency. One such mill, at Bolton—a yarn mill—owned by John Musgrave & Sons, has a pair of tandem compound engines of 1,500 horse-power, built by the same firm at their machine works. The engine-room is of a height equal to that of the building, with glass roof, and a large traveling crane covers the floor space. The driving wheel is 37 feet diameter, grooved for 37 cotton ropes. These ropes lead through a large enclosed space to different floors of the mill, the arrangement being very neat, and the driving exceedingly smooth. The condensing water is discharged into a large reservoir, and is used over and over, the supply coming from a part

of the reservoir remote from the discharge. Each of the mules used in these mills has 1,060 spindles, and one operative attends two mules.

Combination Tool.

We illustrate on this page a new combination tool devised and manufactured by Mr. Richard G. G. Moldenke, 1368 Broadway, New York city. The base is a steel block having upon three of its sides the square grooves shown, and upon the upper side a narrow slot in which can be placed and clamped by a thumb-screw, the upright, which is of sheet steel, and so shaped that it forms a square either outside or in, and also a hexagonal or nut gauge. The larger inclined edge of this piece is half way between the two short steel pieces shown, and at right angles to a line joining them, so that a center square is formed thereby. This piece is also slotted, and carries at one side a flat blade also slotted, and a scribing needle. The latter is used as a surface gauge or scribing block, and, owing to the square groove in the block, can be used on a shaft or arbor for scribing a circle upon any surface at a right or other angle to the shaft and concentric with it. The scriber may also be used as a depth gauge.

LETTERS FROM PRACTICAL MEN.

Wearing Cylinders Large at the Ends.

Editor American Machinist:

In answer to question asked by "I. M., Brooklyn, N. Y.," in the July 11th issue, you say that "it is probably due to an improper alignment."

I can readily see how an improper alignment might cause a cylinder to wear larger at *one* end than at the other, but I cannot see how it could wear larger at *both* ends, if the piston rod went through the center of the cylinder head.

My experience has been more with stationary engines than with locomotives, but I have seen cylinders on both, which were worn larger at *both* ends. In every case where this was observed, the piston packing was what we call the "Dunbar packing," the rings being set out by the steam pressure.

The less of live steam and the more of expansion used, the worse the cylinder.

I am not an expert, therefore I would like to know if I was wrong in supposing that the piston packing, and not the improper alignment, was the cause of the trouble.

Lancaster, N. H. N. C. M.

[You are right in supposing that steam-setting packing, especially where steam is cut off early in the stroke, will wear cylinders large at the ends.]

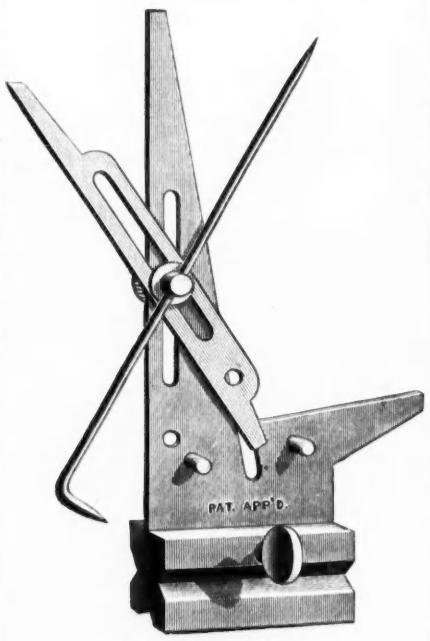
Coal-Cutting Machinery—The Steamship "Danmark."

Editor American Machinist:

There is probably no industry in this country that requires the aid of machinery and the application of power more than that of mining coal. The prime factor in all industries—coal—has been mined exclusively by hand power, until very recently some machines of complex construction and expensive operation have been used in some localities, and, unsatisfactory as they are, they are eagerly sought after, and are being rapidly introduced by the larger operators.

What is wanted is a machine to cut under, along the bottom or near the bottom of the coal to a distance of five feet, more or less, and as narrow a cut as possible—say three or four inches—and, if possible, to make a vertical cut at the side of each room or entry. This being done, a drill hole at the opposite upper corner, and a liberal shot with powder, brings the coal down ready for loading into the pit cars. The serious part of this thing is the transmission of power into the mine. Steam is out of the question; compressed air is used instead, but is very expensive in cost of plant and operation, and renders a meager return for the power expended. Electricity is the popular motor now, and is being tried in mines in several places. This is also expensive, but the dynamo is susceptible of being simplified and cheapened, and the dynamo is also a motor, in fact, a *dynamotor*, and is capable of easy handling and being easily moved from one room to another, and also one motor may be used for several cutting machines, the power being applied by a flexible shaft or otherwise. The current can be carried into the mine at a fraction of the cost of a line of pipes. The dynamo has been brought to a high degree of perfection, but most dynamos lack yet the essential element of accessibility for repairs. Whenever it comes to be made in such a manner that any section can be repaired by an intelligent machinist without disturbing any other section, and at reasonable cost, it must inevitably supersede the air compressor.

It would be interesting to the engineering fraternity to know the reasons why the steamship "Danmark" was abandoned at sea. If such statement has been made, I have failed to see it, and from the way this thing has been concealed, it would seem as if there had been "something rotten in Danmark." We all know the machinery broke down and knocked a hole in her stern compartment, but we were told, also, that she was a good, substantial vessel, built with water-tight compartments, and hence, a hole in one compartment ought not to sink her, unless otherwise caused by neglect or incompetence. It is due to the engineering world that this thing be cleared up. It was perfectly correct to save the people, but it was little less



Combination Tool.

than criminal to abandon the ship. When the writer hereof used to sail the high seas on the Mississippi river, we did it differently; we saved the passengers, and then saved the boat. No Mississippi captain was ever known to abandon his boat and leave her floating around loose. A crew of a British steamer once saved the "Ville du Havre"—or "Ville de Paris," I forgot which—abandoned at sea, and a Yankee engineer saved the "Great Eastern," and it is remarkable that no engineer should have volunteered to save the "Danmark." C. W. Crawford.

Piston Rod Packing.

Editor American Machinist:

The article by Mr. T. T. Parker, in the issue of June 27th, on packing piston rods and pumps, contains many valuable suggestions, but there are two essential parts that have escaped his attention, and these are the crosshead and piston of an engine.

It matters but little what the composition or quality of the packing is, unless the piston rod is kept in its proper position.

In order that the piston rod may be kept in its right position, it is necessary to consider two things: first, to keep the center of the crosshead in line with the center of the bore of the cylinder, and to keep the gibs snugly fitted to the guides; second, keep the piston rings so that the piston rod will move in the center of the bore.

Should either one of these be out of line, it is next to an impossibility to keep the steam from escaping for any length of time, and it takes but a short time to burn the packing, so that drawing up the gland has but a temporary effect on the escaping steam.

The writer was once employed as an "extra," and had to wrestle with an engine in which three days was the extreme limit of wear for five rolls of three-fourths round Empire packing. It was stated that the engine was so badly worn that there would be no advantage in making any special effort to prevent the steam from escaping, as it would be labor in vain.

Taking these things into consideration, and that the place was being only temporarily filled, it was decided to do as the foreman had directed. But in a short time I was given charge of this machine, and one evening, after removing the packing from the stuffing-box, it was noticed that it was burnt and worn only on one part. This suggested an investigation, which disclosed the fact that the piston rod was about $\frac{1}{2}$" out of center. This was quickly adjusted, and next in order was the adjusting of the crosshead and gibs. Some fresh packing was then put in, and no steam escaped the next day, nor for nearly a month, when it became necessary to do a little toning up.

Owing to an increase in business, this engine (12"x24") became too light for the work, and another engine (16"x24") was put in. It was in just about the same shape as the first one, with the piston badly worn by improperly drawing up the glands. The rod was cut and the gland worn. By a little manipulation the rod was in a few days made comparatively smooth, but the steam was hissing at every stroke.

A washer, that snugly fitted the piston, was cut from a piece of sheet-iron, and cut through on one side, to allow it to be put on the rod. It was placed between the packing and the gland, and the rings and gibs were adjusted as in the first engine. Everything went quietly the next day, and the six rolls of seven-eighths round Empire packing lasted about fourteen months.

The engine was run from seven to ten hours each day (Sundays excepted), and was making about one hundred and twenty revolutions per minute. J. F. B.

Prof. Sweet's Lathe.

Editor American Machinist:

The articles describing Prof. Sweet's lathe having been completed, I presume it will be in order for one who has used lathes considerably, and takes an interest in them, to express an opinion regarding some of the features of the lathe.

I, like Mr. Harrop, find much to admire in the lathe, but at the same time notice some points which my personal experience leads me to think could be improved upon. I shall not assume to say that they are wrong, but simply that for my use I should prefer a different construction, and for this preference I will give my reasons, hoping that, if there are considerations entering into the matter which I have overlooked, Prof. Sweet, or some one else, will call attention to them.

In the first place, I think I should dispense with the gap. I am free to admit that it is often very convenient, but it seems to me that the evils which it makes necessary more than counterbalance the good which results from it. It is the gap which prevents there being any bearing for the carriage at the back side in front of the cross slide, and it seems to me that that portion of the slide is essential, particularly in boring with a tool standing out a considerable distance from the tool post, in which case there is a strong twisting moment applied to the carriage which can only be resisted by that part of the slide in front of the lathe which is in advance of the cross slide. I do not think that when such a cut is being taken there is any bearing of the carriage upon the back slide, except at the extreme forward end of it—a fact which will be made apparent when it is considered that, supposing the extreme case of a boring tool projecting out from the post beyond a line connecting the two extreme points of contact of the carriage with the bed on the side next the head; the tendency in such a case would be to tip the carriage forward with these two points as centers of motion, or fulcrums. This could have been avoided by placing the shear at the back below the gap as it is in front, though there may be some reason for not doing this which I do not understand or perceive. The gap also makes it necessary to place the screw very low, and at a considerable distance from the resistance which it has to overcome. Then I must say that I do not like the looks of the gap, nor of the curves on the bottom of the bed resulting from it. This last is, I admit, a trivial objection, but, together with the others I have mentioned, would, I think, lead me to do away with it, useful though it may be at times.

It is possible that I have an exaggerated idea of the refinement necessary to get and keep the spindles of a lathe in a satisfactory condition as regards their alignment, but I can easily detect a difference in diameter between the ends of a hole of .0005" with a pair of inside calipers, and I am not wholly satisfied with a lathe which will not bore a hole so near straight that I am unable to detect a variation in the case of a hole 4" or 5" deep.

It seems to me that it would be exceedingly difficult to set the head-stock of a lathe to do such boring after it had been disturbed, and also that it would be difficult to set the head and foot-stock spindles sufficiently close to be satisfactory, by means of a straightedge applied to the sides of the heads; my standard in this respect being to have the lathe bore straight, and when the foot-stock is set, to turn straight with the foot-stock spindle projecting the smallest possible distance; and have it also turn straight when a piece three inches shorter is placed between centers, the foot-stock not being shifted. I am disposed to think that when the spindles of a lathe are once got into accurate alignment, they should be left so, and a taper attachment used when taper work is to be done.

In the device for clamping the foot-stock spindle it seems to me that I see a chance for an improvement. As shown in the issue of July 18, this consists of a sleeve, which is inserted in the bore from the front, and fits two tapered seats, one at the outer end of the bore, and the other nine inches further in. A thread is cut upon the outer surface of this sleeve, to which a ring is fitted, which, when turned, drives the sleeve inward into contact with the tapered seats at either end, and thus compresses it upon the spindle, the sleeve being split at the ends for that purpose; now it seems to me that it would be difficult to maintain an accurate fit upon these conical surfaces, so that the seating of the two ends would be equally firm, and I should think a better way would be to cut the sleeve in two in the middle, making two sleeves of it, cutting a right-hand thread on one of them, and a left-hand thread upon the other, then, by changing the direction of the inner taper, the nut could act to draw the sleeves together; and since the seating of one would form the resistance against which the other would act, the tension upon them would be exactly equal. Not only this, but there would be no side thrust upon the nut, and it would consequently be easier to operate, all the thrust produced being exerted for a useful purpose, both as regards the action and re-action. It is true that this would require that the tube should be screwed onto the foot-stock instead of being cast on solid; but I think that is no objection, and on some accounts is an advantage in itself.

The best results are obtained from such a paper as the American Machinist, I think, by a free discussion of such matters as these, and if I am wrong in any of the points which I have brought up, I hope to be shown my error. Fay.

All along through France, ponderous four-armed wind-mills can be seen, largely used for grinding grain. The building over which they stand is usually very small, quite eclipsed by the great revolving arms above it. These great wind-mills look picturesque and all that, but they don't look like business. There are some fine wind-mills at the Exposition, but they don't seem to take in the country. The old-time affair adds to the beautiful, and is worth something for that, at least.

Practical Drawing.

BY J. G. A. MEYER.

EIGHTY-SECOND PAPER.

Problem 91.

599. *To find the horizontal projection of a point given in the vertical projection on one of the lateral faces of a pyramid.*

Let $v\,a\,c$ (Fig. 493*a*) be the vertical, and $v_2\,a_2\,b_2\,c_2\,d_2$ (Fig. 493) the horizontal projection of a right pyramid, and let p be any given point on the lateral face $v\,a\,b$ in the vertical projection; it is required to find the position of this point in the horizontal projection.

There are two methods for finding the horizontal projection of this point.

First Method.—Through the given point p in Fig. 493*a* draw a line parallel to the base $a\,c$, cutting the lines $v\,a$ and $v\,b$ in the points e and f. Through the point e draw a vertical line $e\,e_2$ cutting the line $a_2\,v_2$ (Fig. 493) in the point e_2; through e_2 draw a line $e_2\,f_2$ parallel to $a_2\,b_2$. Through the point p draw a vertical line cutting the line $e_2\,f_2$ in the point p_2; this point will be the horizontal projection of the given point p.

This method is based on the following principles: The line $e\,g$, drawn through the given point p in Fig. 493*a*, we assume to represent a cutting plane parallel to the base $a\,c$. The section made by this plane we know to be similar to the base (Art. 596), hence the line $e_2\,f_2$, which is one of the sides of the section, must be parallel to the side $a_2\,b_2$ of the base; here, then, we have two lines, $e\,f$ and $e_2\,f_2$, which are respectively the vertical and horizontal projection of one and the same side of the section. But the line $e\,f$ contains the given point p, therefore the horizontal projection of this point p must lie in the line $e_2\,f_2$. According to Art. 227 the vertical and horizontal projection of a point must also lie in one vertical line; therefore the point p_2, in which the vertical line through p intersects $e_2\,f_2$, must be the horizontal projection of the point.

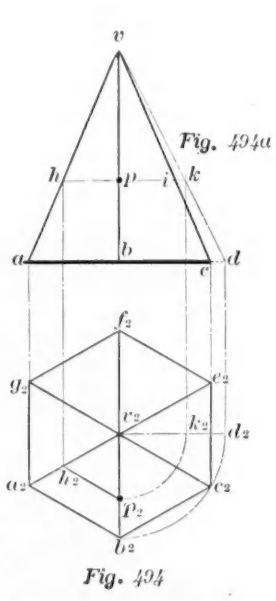


Fig. 494a

Fig. 494

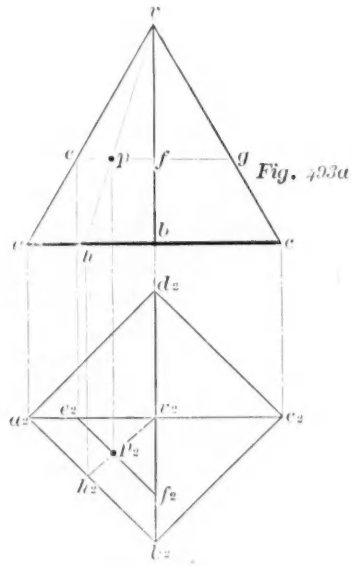


Fig. 493a

Fig. 493

600. *Second Method.*—Through the vertex v, and the given point p (Fig. 493*a*) draw a straight line, and let it meet the base $a\,c$ in the point h. Through h draw a vertical line cutting $a_2\,b_2$ (Fig. 493) in the point h_2; join h_2 and v_2 by a straight line; the line $h_2\,v_2$ will be the horizontal projection, and $v\,h$ will be the vertical projection of one and the same line drawn on the lateral face $v\,a\,b$. But the line $v\,h$ contains the given point p; therefore the point p_2, in which the vertical line through p intersects $v_2\,h_2$, must be the horizontal projection of the given point.

Problem 91*a*.

601. Let Figs. 494*a*, 494 be the vertical and horizontal projections of a pyramid, and let p in Fig. 494*a* be any given point on the edge $v\,b$, which lies in a plane perpendicular to both planes of projection; it is required to find the position of this point in Fig. 494.

For finding the position of this point, we may again employ two methods.

First Method.—Through the given point p in Fig. 494*a* draw a line $h\,k$ parallel to the base $a\,c$, cutting the edge $v\,a$ in the point h; through this point draw a vertical line cutting $a_2\,v_2$ in the point h_2; through h_2 draw a line parallel to $a_2\,b_2$, cutting $v_2\,b_2$ in the point p_2; this point p_2 is the horizontal projection of the given point p.

It will be seen that this method, and that given in Art. 599, are based upon the same principles.

602. *Second Method.*—Through the point v_2, Fig. 494, draw a horizontal line $v_2\,d_2$. From v_2 as a center, and with a radius equal to $v_2\,b_2$, describe an arc $b_2\,d_2$, meeting $v_2\,d_2$ in the point d_2; through the point d_2 draw a vertical line, cutting the base $a\,c$ prolonged in the point d; join v and d (Fig. 494*a*) by a straight line, cutting $h\,k$ in the point k. Through k draw a vertical line meeting $v_2\,d_2$ in the point k_2. From v_2 as a center, and with a radius equal to $v_2\,k_2$, describe an arc, cutting $v_2\,b_2$ in the point p_2, which is the horizontal projection of the given point.

This method is based upon the following principles: Let the pyramid be turned a quarter of a revolution around its axis; the edge $v_2\,b_2$ (Fig. 494) will then be in the position represented by the line $v_2\,d_2$, and will be parallel to the vertical plane of projection (see Problem 84). In this position $v\,d$ (Fig. 494*a*) will be the vertical projection of the edge $v_2\,b_2$. In turning the pyramid around its axis, the path of the point p will be represented by the line $p\,k$, consequently the point k, in which $p\,k$ intersects $v\,d$, must be the position of the point p when the edge $v\,b$ occupies the position represented by the line $v\,d$; or, in other words, when it is parallel to the vertical plane of projection; and the point k_2 (Fig. 494), in which the vertical line through k intersects $v_2\,d_2$, must be the horizontal projection of the point k. Now in turning the pyramid back into its original position, the path of the point k_2 will be represented by the arc $k_2\,p_2$; hence the point p_2, in which the arc $k_2\,p_2$ intersects the line $v_2\,b_2$, must be the point sought.

The points found by both methods must, of course, coincide, otherwise there is a mistake somewhere which must be rectified. The same remarks apply to the points found in the preceding problem.

Directions.—In space marked Prob. 91, draw the vertical and horizontal projection of a right pyramid with a base 4 inches square, altitude 7 inches. In the vertical projection mark off on one of the lateral faces a point p; then find the position of this point in the horizontal projection. Use 3-inch scale.

In the same space draw the vertical and horizontal projection of a right pyramid with an hexagonal base 4 inches across sides; altitude, 7 inches. One of the edges of the pyramid must lie in a plane perpendicular to the vertical and horizontal plane of projection as represented by the lines $v\,b$ and $v_2\,b_2$ in Figs. 494*a* and 494. On this edge mark off any point p in the vertical projection, then find this point in the horizontal projection.

Problem 92.

603. *Intersection of a pyramid with a plane; one of the edges of the pyramid lying in a plane perpendicular to both planes of projections.*

Let Fig. 495*a* be the vertical, and Fig. 495 the horizontal projection of a pyramid whose base is a regular five-sided polygon; let the line $a_3\,c_3$ (Fig. 495*a*) be the given cutting plane; it is required to find the horizontal projection of the section made by this plane.

It may be remarked here, that since the edges represented by the lines $v_2\,e_2$ and $v_2\,d_2$ (Fig. 495) are hidden in the vertical projection, these edges are represented in Fig. 495*a* by the dotted lines $v\,e$ and $v\,d$ respectively; of course the lines $v\,a$ and $v_2\,a_2$ represent one and the same edge; $v\,b$ and $v_2\,b_2$ another edge, and $v\,c$ and $v_2\,c_2$ the third edge of those which are not hidden in the vertical projection.

The manner of finding this section is, with one exception, similar to the method for finding the upper base of the truncated pyramid shown in Figs. 488 and 488*a* (eightieth paper). But with this method we have no means of finding the point b_4, because a vertical line drawn through the point b_3—which is the vertical projection of the point b_4—will coincide with the line $v_2\,b_2$. Hence, for finding the point b_4, we must adopt one of the methods given in the preceding problem, say the second one; all the other points in the required section are found as shown in Figs. 488 and 488*a*. The whole construction is as follows: Through the vertex v_2 (Fig. 495) draw a horizontal line $g_2\,f_2$. From v_2 as a center, and with a radius equal to $v_2\,b_2$, describe an arc, cutting $g_2\,f_2$ in the point f_2; through this point draw a vertical line, cutting the base $a\,c$ prolonged in the point f; join e and f by a straight line. Through b_2 draw a horizontal line, cutting $e\,f$ in the point f_3. Through this point draw a vertical line, cutting the line $g_2\,f_2$ in the point f_4. From v_2 as a center, and with a radius $v_2\,f_4$, describe an arc, cutting $v_2\,b_2$ in the point b_4, which is the horizontal projection of b_3. Through a_3 draw a vertical line, cutting $e_2\,a_2$ in the point a_4; in a similar way draw verticals through the points e_3, d_3, and c_3, cutting respectively the lines $v_2\,e_2$, $v_2\,d_2$ and $v_2\,c_2$ in the points e_4, d_4 and c_4. Join the points b_4, a_4; a_4, e_4; e_4, d_4; d_4, c_4; and c_4, b_4 by straight lines; these will form the outline of the required section in Fig. 495.

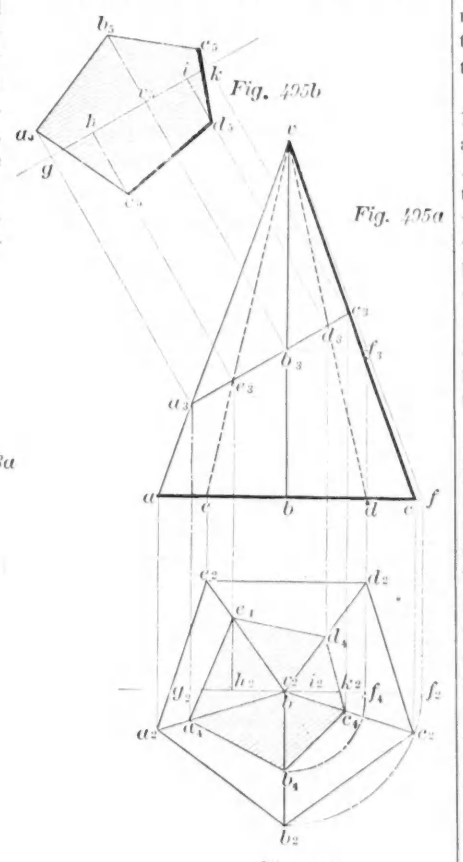


Fig. 495

604. Since the cutting plane $a_3\,c_3$ is perpendicular to the vertical plane of projection, and not parallel to the horizontal plane of projection, we do not see the correct distances between the points a_4, b_4, c_4, etc.; but we do see the correct distance from these points to the line $g_2\,f_2$. Hence, to find the correct form of this section, as shown in Fig. 495*b*, we proceed as follows:

At any convenient distance from the line $a_3\,c_3$, draw parallel to it a line $g\,k$. Through the points a_3, e_3, b_3, d_3, c_3 draw lines perpendicular to $a_3\,c_3$, cutting the line $g\,k$ in the points g, h, e_5, i and k. Make $g\,a_5$ equal to $g_2\,a_4$; $h\,e_5$ equal to $h_2\,e_4$; $i\,d_5$ equal to $i_2\,d_4$; $k\,c_5$ equal to $k_2\,c_4$; and $e_5\,b_5$ equal to $e_2\,b_4$. Join the points a_5, e_5, d_5, c_5, b_5 by straight lines, and thus complete the outline of the shaded part in Fig. 495*b*, which is the true form of the section.

Directions.—In the space marked Prob. 92, draw the vertical and horizontal projections of a right pyramid whose altitude is 8 inches; the base is a regular five-sided polygon, circumscribed about a circle 4½ inches diameter. In the vertical projection draw any oblique straight line to represent the cutting plane; then find the horizontal projection of the section, and also its true form, as shown in Fig. 495*b*. Use a 3-inch scale.

American Workmen Abroad.

At three o'clock the afternoon of last Wednesday the 24th, the Anchor Line steamship "City of Rome" sailed from her pier in the North River for Europe, bearing representatives of the various trades and industries of the United States to the number of forty, four of whom are women, and are the representatives of occupations in which women are usually employed.

When our Centennial Exhibition was held, the Government of France sent over to this country a number of her representative workmen to study particularly the things relating to their vocations, which were to be seen in the exhibition, and this country generally.

The British Government will send to Paris 100 workmen to study mechanical methods and products, and it was hoped that our American Congress could be brought to see the advantage of pursuing the same course with regard to American workmen. A bill was introduced with that object, but probably because there was "no politics in it," it failed to pass, and it seemed likely that those American workmen who saw Paris and the Exposition would do so at their own expense, and would be limited to a very few in number.

What is called "Scripp's League of Newspapers" is composed of six newspapers published in the leading cities of the Central States, and circulating largely among workingmen. This league determined to do what Congress had failed to do in sending a number of representative mechanics and workingmen abroad to take advantage of the unusual opportunities for profitable observation afforded by the Exposition. Labor organizations and employers in the various industries were invited to nominate men skilled in their trades, and also possessed of that valuable quality which enables men to absorb knowledge by observation, and those who seemed to be most generally recommended were appointed to accompany the expedition. Having decided to go into such an enterprise, it is evidently to be carried out in the thorough and liberal style characteristic of American newspaper undertakings, the travelers coming to New York in a Pullman vestibule train, taken in carriages to a hotel where they took dinner, from whence they went in carriages to the pier. The best accommodations had been secured for them on board the steamer, and it is evident that nothing is to be considered too good for them during their journey.

The forty persons represent as many distinct occupations, the machinists being represented by R. M. McBeth, of Cincinnati; the engineers, by Joseph Thorp, of the Mobile & Ohio Railroad; the foundrymen by Robert E. Masters, manager of the Marshall Car Wheel and Foundry Co., Marshall, Texas; the blacksmiths by Edmund G. Vail, of Cleveland; sewing machine building by George E. Titcomb, of Cleveland; brass working by C. C. McGlogan; car building by William Milligan, of Detroit; wood-working by Frank H. Hotchkiss, of Muskegon, Mich.; safe and lock making by Thomas Kearney, of Cincinnati; ship building by Frederick D. Wheeler, of Bay City, Mich.; and the stove industry by William J. Keep, superintendent of the Michigan Stove Co.'s works, whose papers, read before the American Association for the Advancement of Science, on the effect of aluminum in iron, have attracted so much attention in this country and Europe, and who also originated the "Keep tests" for iron. Most of the men chosen occupy positions of trust and responsibility in their respective vocations, and they constitute a body of men of which Americans need by no means be ashamed. We think the expedition will result in much good to its members, and to the industries which they represent.

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J. G. A. MEYER, } Associates.
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The Reading Organizations.

Of course no one doubts that the president of the Reading Railroad system, Mr. Austin Corbin, believes in organization among men who, having the same objects in view, are able by means of their organizations to attain that object more easily, or in a more perfect manner than would be possible without organization.

The prominent part which Mr. Corbin has taken, and is taking, in various organizations, is proof that he thoroughly believes in them as a means of making money, which seems to be the sole aim of Mr. Corbin's life.

What more natural, or more to be expected, than that the workingmen employed by the various organizations to which Mr. Corbin belongs should, seeing his remarkable success with them, desire to try the plan for themselves? They conclude to do so, but have no sooner got fairly started than it is made apparent that Mr. Corbin does not believe in *all* organizations, and is strenuously opposed to allowing indiscriminate organization among men by whomsoever may happen to think that their particular interests may be conserved thereby; evidently believing that this matter of organization is a thing which can be carried too far—at least in certain directions—that there is need of some restraint—some control over the business of forming organizations, and, moreover, that he, Mr. Austin Corbin, is the very man to decide what particular organizations are improper, and to suppress them. He accordingly informs the American citizens, or, in other words, the "uncrowned kings" who labor in the employ of his organizations, ycleped the Reading Railroad, the Reading Coal & Iron Co., the Reading Iron Works, etc., that henceforth he himself, Mr. Austin Corbin, will attend to all the organizing, and that it is their particular business to attend strictly to their work, and accept without a murmur the compensation decided upon by Mr. Corbin and his fellow organizers as being the proper amount, and that employment can only be secured or retained upon condition of renouncing membership in all organizations not approved of by him.

Of course, no one who has paid the least attention to the course pursued by the organizations which Mr. Corbin has endorsed, and which are managed by him, will for one moment entertain the idea that his opposition to a given organization may be founded upon apprehension that it may become a lawbreaker; may engage in dishonest or dishonorable practices; may, by the use of money, corrupt legislatures, and secure the passage of laws detrimental to the interests of society; may corrupt the courts, and thereby practically annul laws duly enacted by the representatives of the people in their interest, or may be so managed as to enable its officers to defraud and rob the ordinary lay members. Instances are plentiful which go to prove that such things meet with the entire approval of Mr. Corbin, when they are managed by organizations which he controls, and result in turning money into his pockets.

The report of a Committee of Congress, which we have before alluded to, and the testimony contained therein, though we have no idea that it exposes all the rascality which Mr. Corbin has perpetrated by means of his organizations, exposes so much of it that one would think that, if he were not entirely lost to the sense of shame, and absolutely reckless of the opinions of his fellow men, as well as of the security and peace of society, he would subside and endeavor to attract as little attention as possible. But the trouble with Mr. Corbin, and men of his class, seems to be that they think they can afford to despise, and ride rough-shod over society and its laws, if only they make sufficient money by so doing; imagining, apparently, that if worse comes to worst, and society should determine to rid itself of their tribe at any cost, the Government will step in and protect them from harm, forgetting that the Government derives its power and authority from the people, and that, when a sufficient number of them unitedly determine to do a thing they will do it, their right to do so being clearly recognized and declared in the preamble to the Declaration of Independence, which was and is the real foundation of our Government.

We do not wish to appear in the role of alarmists, but we sincerely believe that a way must be found to suppress the tribe of Corbin. We hope and believe that a peaceable and lawful method of doing so will be discovered; but in the meantime they are a greater danger to society than all the common thieves and thugs in the country, and if there is but one good reason in the world why men should organize with the object of securing what they desire, it is to be found in the fact that Austin Corbin is opposed to it.

What strikes the average American as one of the silliest of regulations at the Paris Exposition, is that which makes it an offense to make rough sketches of machines. Nearly all exhibitors, with the exception of those from England and the United States, take special pains not to show anything but the bare outside of their machinery, and to show that at as great distance as possible. Then the luckless fellow who tries his hand at sketching an inconsequential lever or something of the sort, is warned of the consequences, his sketch destroyed, and if at all persistent in his search after knowledge, he is marched to the police department, and perhaps from the ground. This for the first attempt. We are not sure what the punishment for the second attempt would be—very likely something less than decapitation. There probably never was another exhibition of machinery, in which so much effort was put forth, both to make a show and to avoid giving information. It reminds one of boys swapping jackknives, "sight unseen."

Many readers of the AMERICAN MACHINIST will be pleased to know that A. G. Brown, who went to England three years ago in connection with the Westinghouse engine, has established himself with the well-known firm of John Musgrave & Sons, of Bolton, England, where he is superintending the manufacture and sale of steam engines upon which he holds several patents. Mr. Brown has a separate department of the works for manufacturing, and he is fitting up with special tools as rapidly as possible, for building his engines. He already has a good trade, with excellent prospects for future business. He is doing good work, which is reasonably sure to be appreciated. Every one will hope that he will reap the reward of first-class mechanical skill and a close study of steam engineering.

In European lathes, and other tools requiring centers, exhibited at Paris, the centers are turned at an angle of forty-five degrees. American tool builders are convinced that sixty degrees is a better angle, and it seems to us that must be the experience of every lathesman. When it is necessary to work down close to the center, a forty-five degree angle is vexatiously in the way, and it wears the center in a mandrel out of truth quicker than a sixty-degree angle will. It would be of interest to know just what brings about this difference in practice. We are inclined to believe it is the disposition of the workman in re-turning centers to stunt the angle; forty-five degrees comes nearer to what the average latheman will turn his centers, unless he is kept to gauge, which, it is needless to remark, he should be.

Those who remember the fine display of steam pumps at the Philadelphia Centennial, and remember the fine effect produced by their operation in the space set apart for the purpose, will be disappointed at not seeing anything approaching this display at Paris. A few belted pumps, laboring at a spasmodic stream of water, comprise about all there is in the line of pumps. Everything goes to show that American manufacturers are ahead in their ability to handle water by means of pumps.

A few years ago our Mississippi river boats were held up as awful examples of the use of high-pressure steam. Now, afloat or ashore, we are falling a long way behind European practice. Two hundred pounds pressure for engines large and small is about what they favor in Europe. But they make their boilers correspondingly strong.

In fact, the desire for high-pressure steam in European engineering practice appears to be gradually leading to the use of sectional boilers. American types of sectional boilers are very extensively used, and at the Exposition a variety of such boilers are shown. In some parts of England the Lancashire boiler continues to be the favorite, and the Galloway boiler holds its own very well, but the demand for higher pressures is telling against these types to some extent. However, with internal furnaces it is practicable to make the external shells of almost any thickness; hence large diameters and high pressures are not inconsistent. It is probable that internally fired boilers will be more common in America in the future than they have been in the past.

Literary Notes.

THE TABOR STEAM ENGINE INDICATOR. John Musgrave & Sons, L't'd. Globe Iron Works, Bolton, England.

This book, although prepared in the interest of the Tabor indicator, for which the firm above named are agents, is not in any sense of the word a trade circular, but contains instructions equally applicable to the use of any indicator. It has been prepared by Mr. A. G. Brown, who is a thoroughly practical man, and a close student of matters pertaining to steam engineering.

The author starts out by describing the leading principles involved in the construction of the modern steam engine indicator, and illustrates and describes the Tabor indicator in particular. The care of the instrument, and the proper manner of attaching it to the cylinder of an engine, receive proper attention, and methods of giving motion to the drum are illustrated.

The use of the indicator in assisting in determining the economy of a steam plant is treated in a plain manner, and a section is devoted to the thermal unit measure of engine performance.

Working up the diagrams, comparing the actual with the theoretical curve, and the various details of reading the diagram, are thoroughly gone over with the aid of the necessary illustrations.

A large number of useful tables are contained in the book, and diagrams representing different practice are interspersed. The book can be obtained from the firm named above for one dollar, and it will be found cheap for the tables alone, some of which have been prepared at great pains.

ELECTRICAL RULES, TABLES, TESTS, AND FORMULAS. By ANDREW JAMIESON, C. E., F. R. S. E.

This book contains the formulas and numerous tables used by electricians, and gives concise directions for all calculations, tests, etc., with engravings of the apparatus employed. The work includes the following subjects: Formulas of the Absolute Units, Practical, Electrical, Mechanical, Heat, and Light Units, Electro-Chemical Equivalents, Electrolysis, Heat and Energy of Combustion, Practical Methods of Electrical Measurements, Electric Conductors, Copper, etc., Insulators, Gutta Percha, etc., Batteries, Submarine Cables, Aerial Land Lines, Electric Lighting and Transmission of Power. The book contains 64 pages, 21 illustrations, and forms a good electrician's pocket companion. Although a valuable work, its value as a book of reference would have been enhanced if it had contained a more extended table of contents. The book is published by the Industrial Publication Co., 9 Barclay street, New York. Price 75 cents.

We have received the initial number of *The Steamship*, a new monthly journal of marine engineering and steamship building, edited by John Lockie, C. E., Whitworth scholar. The first number contains a variety

of articles of interest pertaining to the subject indicated by its title, and we should think the new journal would be likely to be welcomed by all who are interested in such matters. It is published at 2 Custom-house Chambers, Leith, Scotland.

QUESTIONS AND ANSWERS

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(298) J. H., Detroit, Mich., asks: Will you please inform me how to find the relative diameters of cone pulleys? *A.*—See our issue of Dec. 1, 1888.

(299) H. G. S., Pekin, Ill., asks: 1. Of what kind of wire are the Stow flexible shafts made? Should it be spring wire or otherwise? *A.*—We have referred your questions to the Stow Flexible Shaft Co., who have refused to give us the required information. We think, however, that any manufacturer of steel wire can furnish you with the proper material. 2. How can I make a spiral spring of closed coils? *A.*—If you have only a few of these springs to make, you can wind the wire on a straight mandrel in a lathe. If you have many of them to make, we should advise you to get a machine made for the purpose.

(300) S. F. O., Brownsville, O., writes: I am designing an engine, diameter of cylinder, 3 inches; stroke, 4 inches. Distance from center of cylinder to center of crank-shaft, 19.9675 inches. The engine is to have a link motion; the eccentrics are 5 inches in diameter; travel of valve, 9-10 of an inch; length of eccentric rods, 9.08625 inches. Do you think that the length of the eccentric rods is about the right proportion? *A.*—It is advisable to make the eccentric rods as long as the design of the engine will admit, because long eccentric rods will give to the valve a more symmetrical motion than shorter ones. Since we know nothing of the general design of your engine, we cannot express an opinion on the length of the eccentric rods.

(301) C. B., Roslindale, Mass., has sent us a sketch of a rectangle, 5x13 inches, and states that in cutting the rectangle through one of its diagonals, thus forming two triangles whose altitude is 13 inches and base 5 inches, and again cutting each triangle at 5 inches from the base and parallel to it, the four pieces can then be put together so as to form a polygon 8 inches square. Now since the area of a rectangle 5x13 is 65, and that of the square is only 64 square inches, our correspondent wishes to know what becomes of the one inch of difference in the two areas. *A.*—The pieces obtained by cutting a rectangle in the manner here stated will not form a perfect square; the area will always be 65 square inches, no matter in what manner the pieces are put together.

(302) C. W. H., Chicopee Falls, Mass., asks: What should be the size and shape of the ports for a steam cylinder 2½ inches diameter, and 5 inches stroke? *A.*—The size of ports will depend on the piston speed, which you have not given. Rectangular steam ports ¼ inch wide and 1 inch long, and an exhaust port ⅛x1 inch will probably be sufficient for all practical purposes. 2. Should the steam begin to escape before steam enters the other end of the cylinder? *A.*—Yes; in fact, using a slide valve with outside lap, so that steam will be cut off at ⅛ or ¾ stroke, the steam will exhaust at one end of the cylinder before steam is admitted at the other end; and this cannot be prevented without interfering with the smooth working of the engine. As for the books you seek, we do not know of any published on the subject you mention.

(303) C. P., East Saginaw, Mich., writes: I have an engine 10x16 inches, slide valve engine; the engine is made to run over. The eccentric is cast to the crank; steam chest is on top of cylinder; there is no rock shaft. I want to make the engine run under. Please give me a plan of doing this. *A.*—In order to change the direction of the motion of engine, the relative position of the eccentric to the crank must be changed. To find the new position of the eccentric, draw a center line lengthway on the crank, and then set the eccentric on the opposite side of the center line of the crank; the distance from the center line of crank to the center of eccentric in its new position must be equal to the distance from the center line of the crank to center of eccentric in its old position. Whether you will be compelled to cast a new crank and eccentric, or simply cut off the eccentric from the crank and replace it by a separate eccentric set into the right position, will depend on the design of the engine.

(304) J. S. B., Ithaca, N. Y., asks: What book or books should be read in order to cover the ground which the stationary and marine engineers' examinations cover? Also, give any other particulars to obtain a license. *A.*—In the first place, you must have a fair knowledge of the elementary branches of mathematics, such as arithmetic and geometry; and a fair knowledge of the elements of algebra will certainly be of great service to you in studying books treating on the steam engine. "Manual of the Steam Engine," by Prof. A. Jamieson, and the "Treatise on the Steam Engine" by the same author, contain much information which will be of great assistance during an examination for an engineers' license. If, in addition to these, you master the "Catechism of the Steam Engine," by John Bourne, and the "Manual of Marine Engineering," by A. E. Seaton, there should be no difficulty in passing an examination for any kind of engineers' license, that is, so far as theory is concerned. Besides this, you will need a practical knowledge of running engines, and this knowledge cannot be found in books, but can only be obtained in practice. The rules and regulations for obtaining a license for a stationary engineer vary in different cities and localities, and for these rules you must apply to the proper authorities. The requirements for obtaining a marine engineers' license have been given in answer to Question 320, in our issue of July 7, 1888.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.
Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.
$100 Reward, page 14.
$100 Reward, page 14.
$100 Reward, page 14.
Shafting Straighteners. J. H. Wells, Tampa, Fla
Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.
20″ Upright Drills. J. E. Snyder, Worcester, Mass.
23″ Upright Drills. J. E. Snyder, Worcester, Mass.
25″ Upright Drills. J. E. Snyder, Worcester, Mass.
28″ Upright Drills. J. E. Snyder, Worcester, Mass.
Light Gear Cutting. R. M. Clough, Meriden, Conn.
Worcester (Mass.) Polytechnic Inst. See advt.
"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.
The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.
R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.
Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.
Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.
Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.
Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortland st., N. Y.
Best silk wiping towels for machinery in the market. S. A. Smith, 23 S. Canal st., Chicago, Ill.
Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.
Iron Planers from 16″ to 36″ wide by any length. H. C. Pease & Co., Worcester, Mass.
Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See July 25, p. 10. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.
Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.
All sizes of Taps & Dies from 5-64 of an inch to 4 inches V, U. S. S., Whitworth, Square & Left-Hand Threads. M'f'd by S. W. Card & Co., Mansfield, Mass.
The best emery wheel made is the "Norwich." For particulars send to Montgomery & Co., 105 Fulton st., New York.
For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.
The hook on steam engines is being supplanted by the Dill disconnecting device made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.
Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.
W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.
Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by writing to The Hornell Iron Works, Hornellsville, N. Y.
Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.
Patterson, Jordan & Gottfried, 146-150 Centre st., N. Y. Metals, Machinery, Hardware, Tools and Supplies for Machinists, Mills, Engineers, Brass Goods Mfrs., Factories, etc. An extensive assortment of Bolts, Screws, Wire, Taps, Drills, etc., carried in stock.
Patent or shop rights for sale, for perforating iron or steel plates for steam boilers, bridge work, iron or steel ship work, marine boiler heads, equal to drilled work and fifteen times quicker. Samples can be seen and circulars obtained from R. E. Dietz, 60 Laight st., New York.
"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.
"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.
"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including July 18, 1889 issue, 81 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.
"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 96 articles have thus far appeared up to and including the July 25, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

E. S. Beaumont will build a foundry and machine shop at Mayfield, Ky.

W. G. Barron will build a wood-working factory at San Augustine, Texas.

The Monongahela Furnace Company will build two blast furnaces at McKeesport, Pa.

Tomlin & Cowden will rebuild their saw and planing mill, recently burned, at Piedmont, Ala.

The Asheville Furniture and Lumber Manufacturing Co., Asheville, Tenn., has been organized.

The Cumberland Fire Brick Co. has been organized, and will establish works near Middlesborough, Ky.

A stock company has been organized to build pumps at Dayton, Tenn. J. W. Williamson is president.

The Martin Elevator Company, of Manitoba, will build nine elevators along the Northern Pacific Railroad.

The Challenge Shingle Machine Co. is a new organization at Anniston, Ala., for making shingle machinery.

The American River, Land and Lumber Co. will build a saw mill and a sash and door factory at Folsom, Cal.

A company, with which R. J. Sanderson is connected, has been organized, to build a woolen mill at Leeds, Kansas.

A company has been formed at Batesville, Ark., to manufacture charcoal and wood alcohol. J. C. Yancy is president.

The Richards Paper Company will build a pulp mill at South Gardiner, Maine. The building will cost about $150,000.

The Coosa Sewer Pipe Manufacturing Co. has been organized, and will build works at Gadsden, Ala., to cost $40,000.

It is said that three-fourths of the patent leather used in this country is made at Newark, N. J. There is talk of forming a trust.

Nicholson & Waterman, Providence, R. I., have received an order from the Pennsylvania Railroad Co. for their broaching, facing and stay bolt threading machinery.

At New Berne, N. C., W. E. Snelling and William Lorch are organizing a co-operative stock company to build a cotton mill, and the capital stock is reported at $50,000.

It is reported that the Burr Machinery Co., of Grand Rapids, Mich., will build branch works at Chattanooga, Tenn. They manufacture wood-working machinery.

It is announced that the death of Mr. Lucius W. Pond will not interrupt the continuance of the business of which he was the head. The company will continue the business as before.

The Overman Wheel Company, Chicopee Falls, Mass., is putting up a new building, 35x180 feet, four stories high. The company is introducing oil fuel, and the Aerated Fuel Company's system of burning it.

The Virginia & Erie Railroad Company has been organized with Mr. John King, President of the Erie, as its president. It will be eight miles long, and will run from Niagara Falls to Tonawanda, N. Y.

The citizens of Havre de Grace, Harford county, Md., are considering the question of issuing $30,000 in bonds to aid in the proposed transfer of the shoe factory of Faust & Son from Baltimore to that place.

The Marietta (Ohio) Foundry, at Marietta, has been succeeded by the Marietta Casting Company, recently chartered. Additional buildings are being erected and equipped for the manufacture of hollow ware.

A narrow gauge railroad is to be built to run from Aspen, Colorado, to Ashcroft, a distance of twenty miles. It will be called the Aspen Mountain Railway, and it is expected that work will begin some time this month.

The National Machinery Co., Tiffin, Ohio, have received an order from the Pennsylvania Railroad Company for bolt cutters for the Altoona shops. This is considered by the National Co. as an excellent endorsement of their machinery.

The Oakdale Manufacturing Co., of Jamestown, N. C., is erecting a new building for its cotton mill, and proposes adding new machinery to increase capacity about one-third, the present capacity being 4,000 spindles. Electric lights will be put in.

The McKeesport (Pa.) and Duquesne Bridge Company, which will build a bridge across the Monongahela river, at McKeesport, that will cost $200,000, has increased its capital stock to $300,000.

E. & B. Holmes, Buffalo, N. Y., manufacturers of wood-working machinery, have issued a very complete catalogue of their productions, in the form of a large illustrated catalogue. The engravings and descriptive matter in the catalogue are very complete.

The Carson City mint, which has been idle since 1885, is about to resume active operations in accordance with a recent decision of the Treasury Department. It is expected to begin active operations about July 1, with a capacity of $200,000 per month.

Huston & Sons, of Coatesville, Pa., will build a new mill entirely of iron, and fitted up with the most improved modern machinery. Several sets of rolls, 10 feet long, 36 inches diameter, and a large steam crane for conveying iron piles to and from the furnaces will be put in.

Abrams & Kelly, of Monongahela City, Pa., are building a foundry and machine shop. They will do general jobbing work, and manufacture the patent "Kelly Pit Car Wheel." Mr. Jas. R. Robinson, recently a student of Cornell University, will have charge of the machine department.

The Betts Machine Co., Wilmington, Del., have received a large order from the Pennsylvania Railroad Co. for machinery for the new locomotive works at Altoona. It comprises lathes, planers, boring mills, and horizontal and radial drills; they will be completed some time during the fall.

The World Lubricating Company has filed articles of incorporation at Albany, N. Y. The object of the company is the manufacture and sale of lubricants. The capital stock is $50,000, and the incorporators are Franklin E. Howard, of Buffalo; Charles H. Phillips, of Cassadaga, and Charles Clute, of Dunkirk.

L. P. Valiquet and F. G. Spencer have associated themselves together under the name of the Manhattan Tool Co., their place of business being at 142 Fulton street, New York city. They build fine tools and intricate machinery for watchmakers, opticians, and machinists, and do model and experimental work.

The New York Central Iron Works, Geneva, N. Y., have issued a new circular, illustrating and describing boilers and engines made at their shops. They pay particular attention to steam heating, using Dunning's self-feeding magazine boilers for generating steam. The catalogue contains many letters commending this boiler.

Island City, Texas, is to have a new cotton mill that will be one of the largest in the South. It will be known as the "Galveston Cotton and Woolen Mills," and the company operating it has a capital stock of $500,000, four-fifths of which has already been subscribed. Land has been purchased, and the first mill of 30,000 spindles will be erected at once.

The Otis Steel Company, of Cleveland, Ohio, has been formed into an English company with a capital of £900,000. The new company has issued shares, which have been offered to the public through the Trustees, Executors and Securities Insurance Corporation. The issue is divided into £300,000 first mortgage debentures, £300,000 8 per cents, and £300,000 ordinary.

Gordon, Strobel & Laureau, engineers, Philadelphia, Pa., have issued a catalogue of automatic and variable cut-off blowing engines for blast furnaces, Bessemer works, air compressors, etc. The catalogue is illustrated quite completely, and information of value is given. This company also manufacture feed-water heaters, which are fully illustrated and described.

The plans for the new cotton mill at Adams, Mass., which is to stand on the site of the old Plunkett mill, are completed, and it is expected that work will begin the first of August. It will be a four-story brick building, 100x300 feet, exclusive of the wings, and will contain as much, if not more floor space than any other mill in the country. It will cost about $500,000, and furnish employment to about 500 hands.

The Winnipesaukee Lake Cotton and Woolen Manufacturing Co.'s property, at Laconia, N. H., has been sold to a syndicate of New Hampshire men for about $90,000. The syndicate is composed of John S. Crane, of Lake Village; J. W. Busiel & Co., of Laconia; Warren F. Daniels, of Franklin; P. C. Cheney and Joseph C. Moore, of Manchester; the Laconia Car Company, and the Cole Manufacturing Co. and some others.

The Tradesman says: "The Roebling Works, of Trenton, recently shipped a wire cable for the Denver City Cable Railway Co. The weight of the cable is 100,970 pounds; it is a trifle over seven miles in length, and is said to be the largest single wire cable ever shipped by the Roebling Works. The car on which the cable was shipped is constructed of steel, with 16 wheels, and weighs 54,400 pounds, the total weight of the car and its load being 155-370 pounds."

The foundation for the new and extensive addition to the St. Louis Iron and Machine Works has been laid; the floor is being filled in with moulding sand, and the brick and iron work are about to be started. The entire structure will be covered with an iron roof, and travelers will be used through the full length of the buildings, instead of cranes. The blowers, fans and all other parts of the equipment will be of the latest and most improved pattern.—*Age of Steel.*

Machinists' Supplies and Iron.

NEW YORK, July 27th, 1889.

Iron—American Pig.—The general condition of the market has somewhat improved since our last report, the lower grades having moved upward in price in accordance with the recent advance in foundry grades. We quote, Standard Northern brands, No. 1 X Foundry, $17 to $18; No. 2, $16 to $16.50. Southern brands, No. 1, $16.50 to $17; No. 2, $15.50 to $16; Grey Forge, Northern, $15.25; Southern, $15.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

A young mech. draftsman is now open for engagement. Address BOX 4, AMERICAN MACHINIST.

A foreman of agricultural foundry desires a change; reference from firm I am now with. Address BOX 7, AMERICAN MACHINIST.

Wanted—A first-class sheet-brass worker; one accustomed to stamping and spinning lamp work; good pay to right man. Metal Worker, AM. MACH.

Norwegian mech. eng'r and shipbuilder, graduate from inst. of technology; 13 years' exp., desires position as draftsman or foreman. F., AM. MACHINIST.

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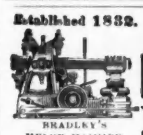

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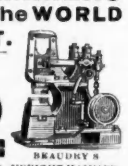

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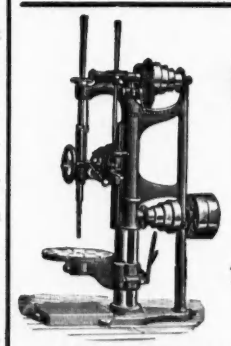

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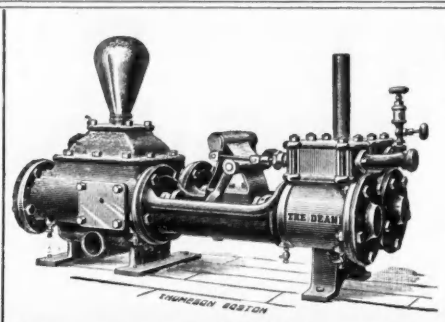

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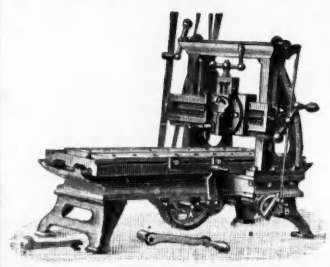

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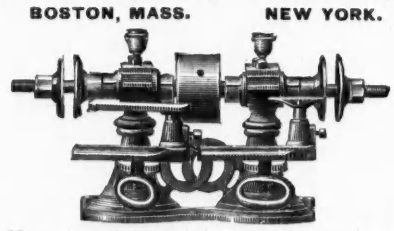

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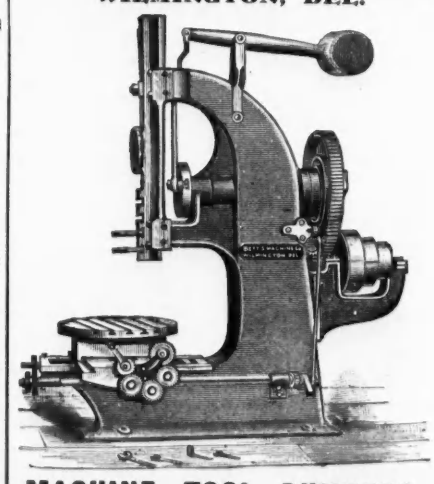

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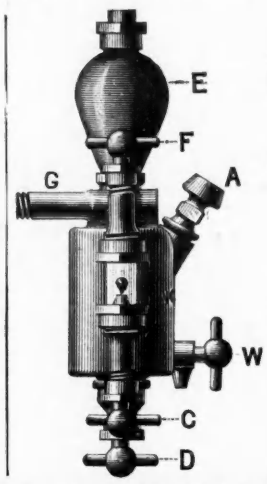

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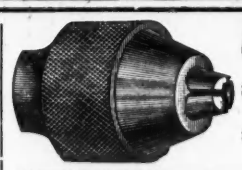

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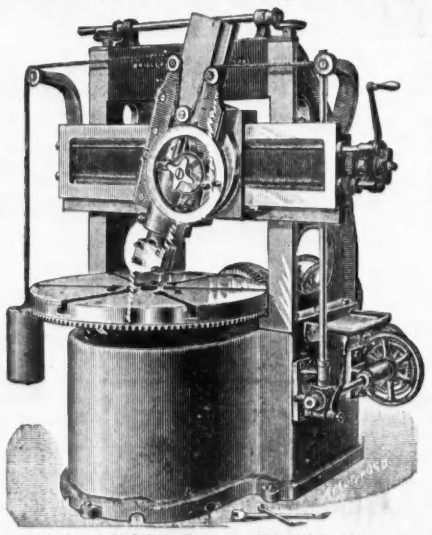

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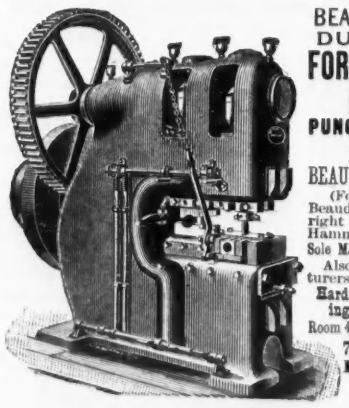

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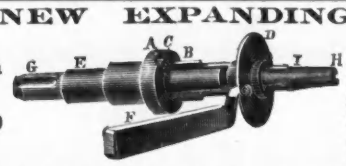

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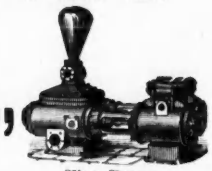

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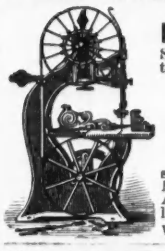

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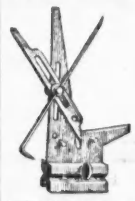

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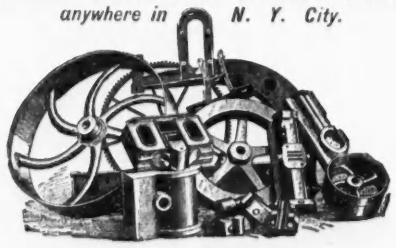

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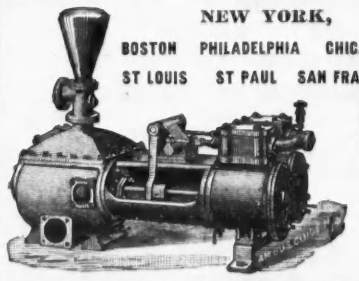

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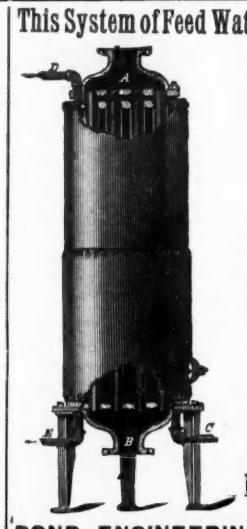

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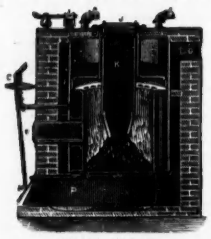

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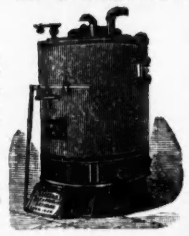

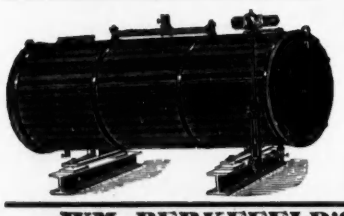

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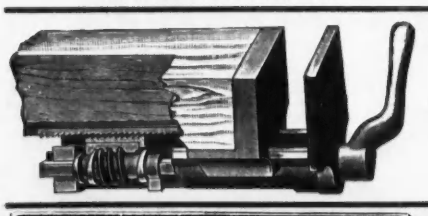

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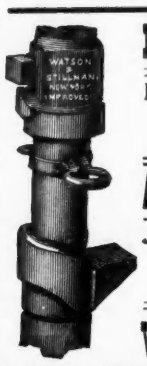

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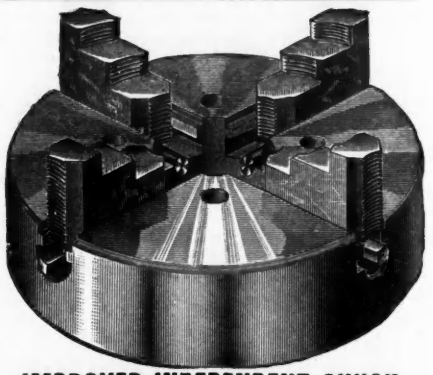

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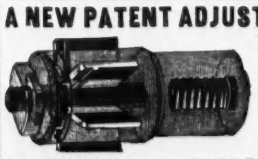

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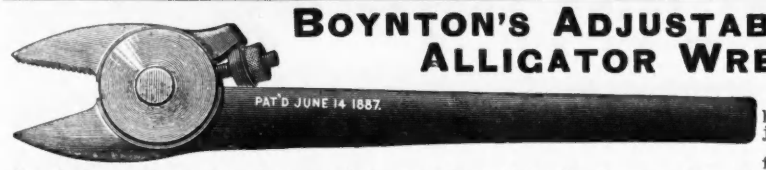

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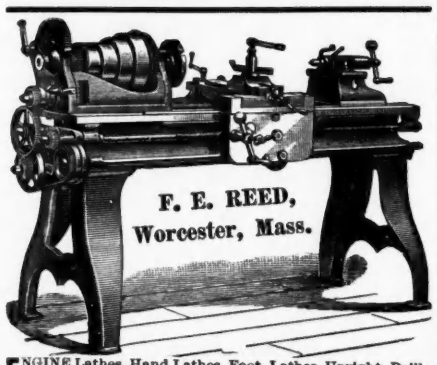

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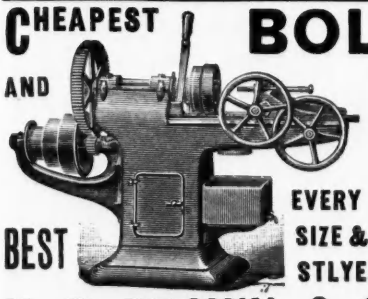

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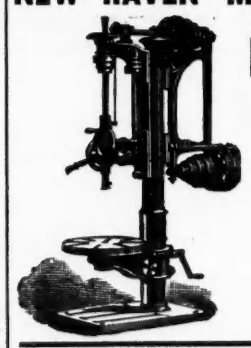

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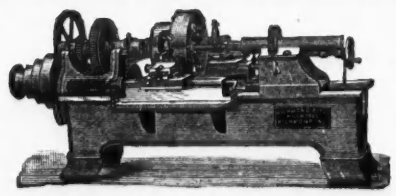

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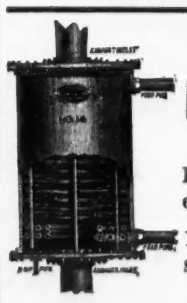

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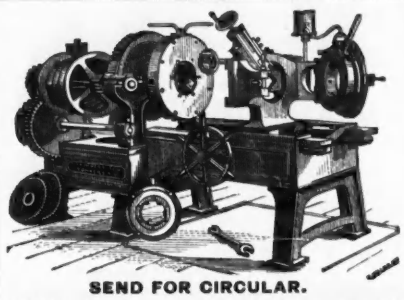

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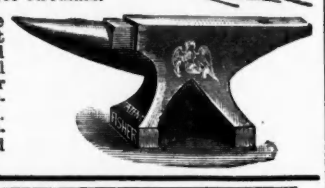

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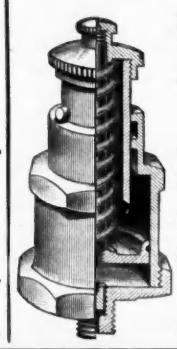

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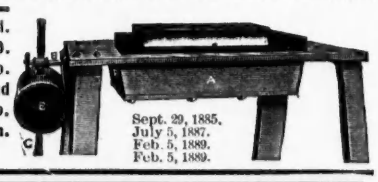

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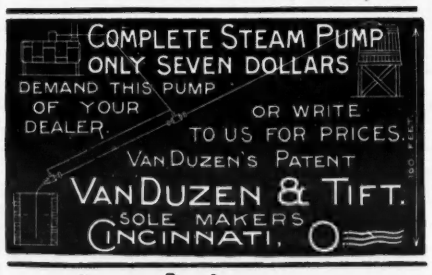

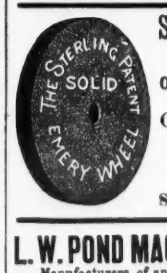

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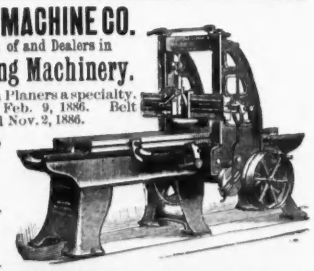

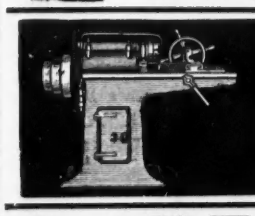

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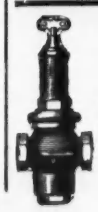

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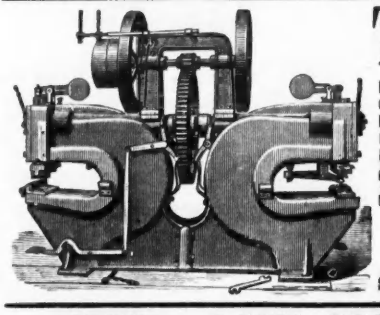

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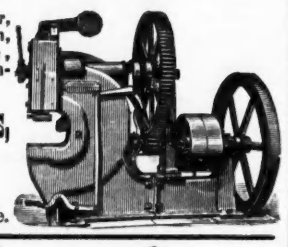

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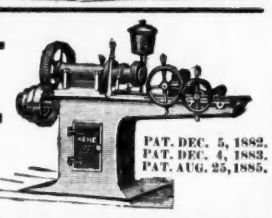

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Write for descriptive circular and prices. Mention this paper.

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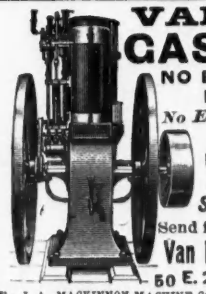

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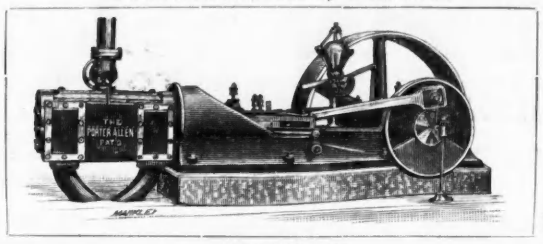

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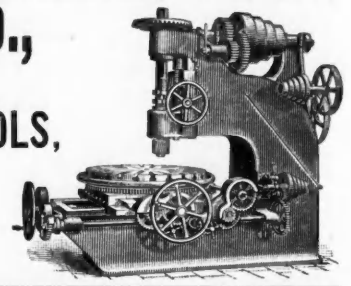

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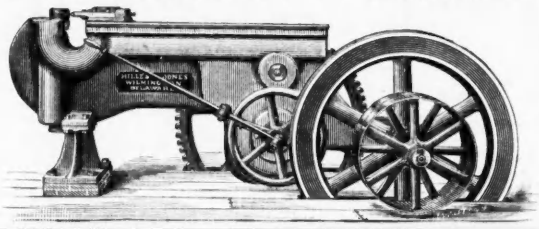

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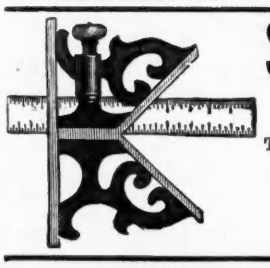

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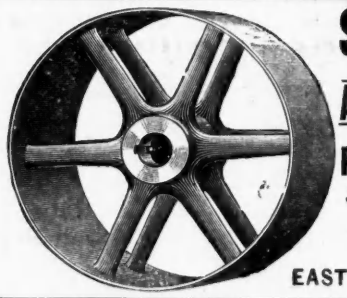

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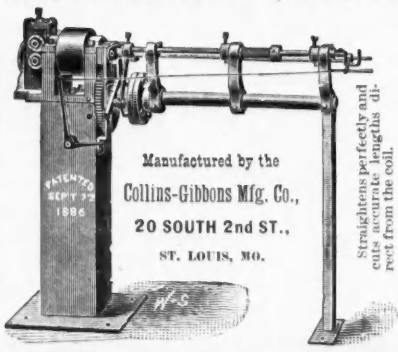

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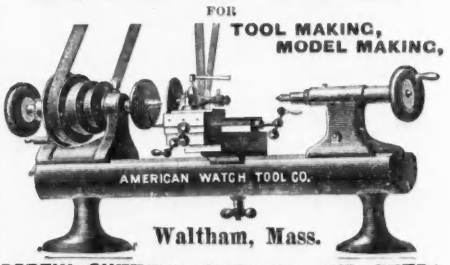

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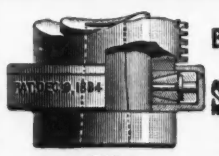

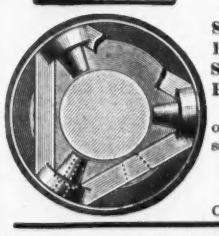

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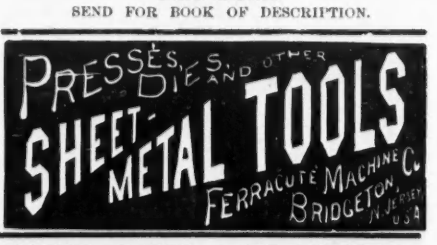

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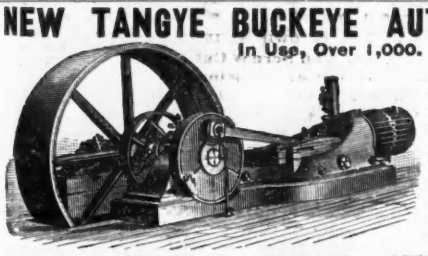

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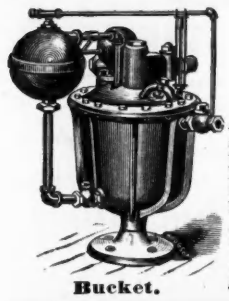

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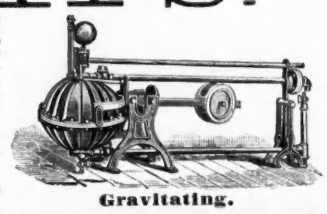
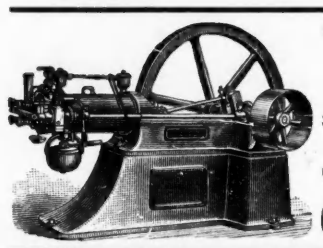


Gravitating.



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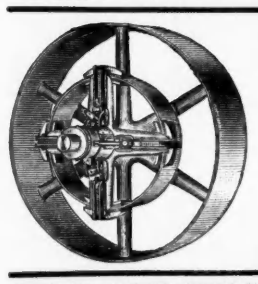

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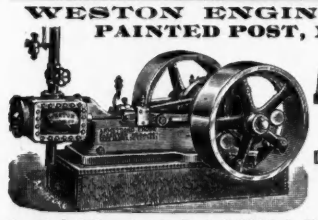

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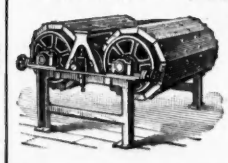

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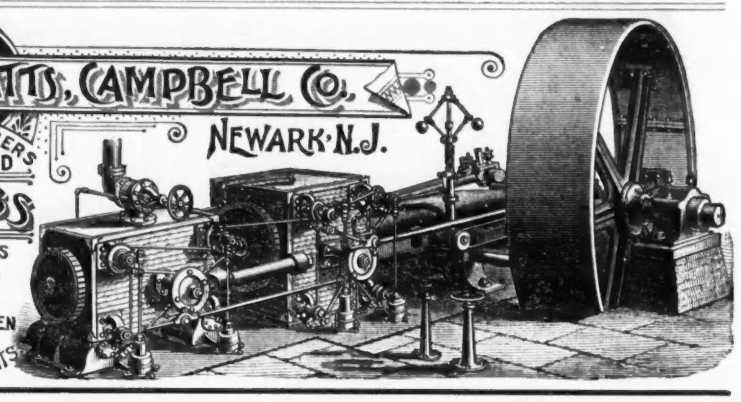

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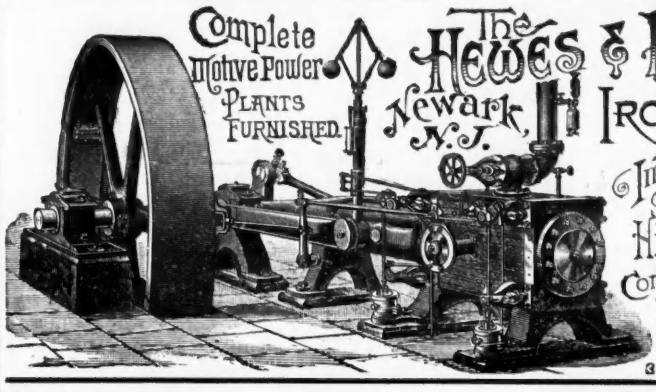

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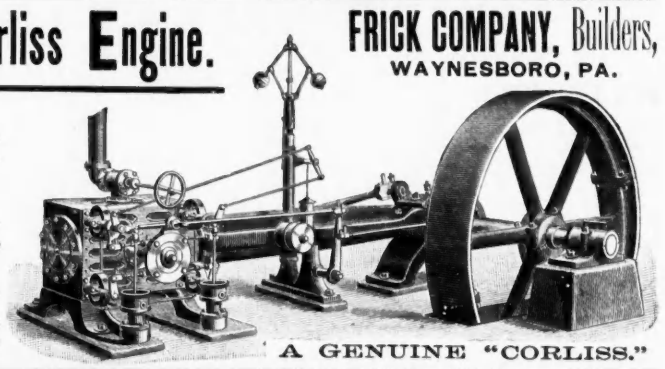

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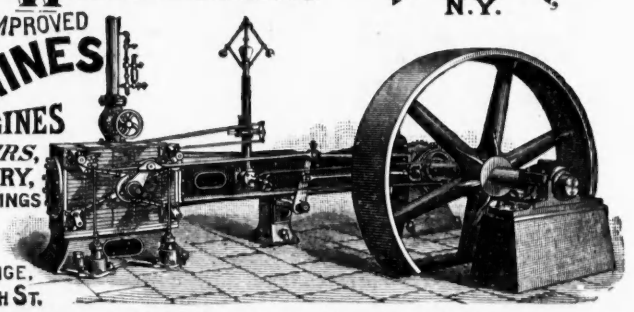

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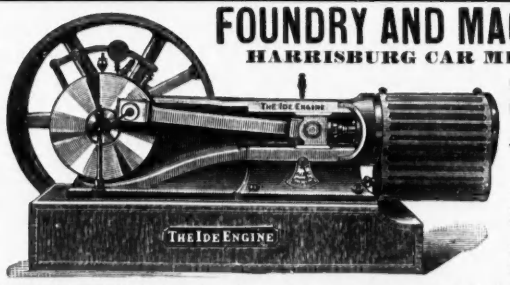

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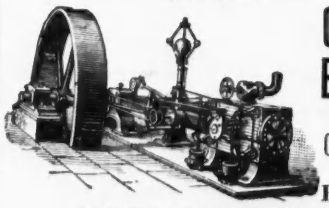

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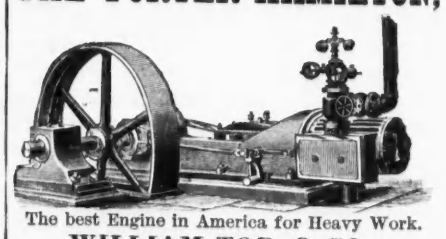

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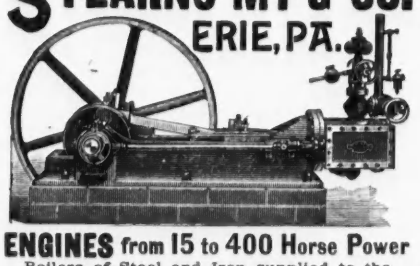

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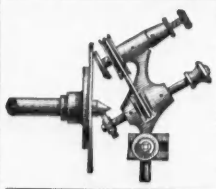

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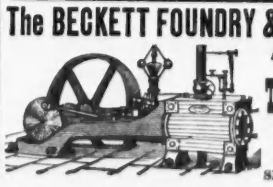

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Made by BROWN & SHARPE MFG. CO., Providence, R. I., U. S. A.

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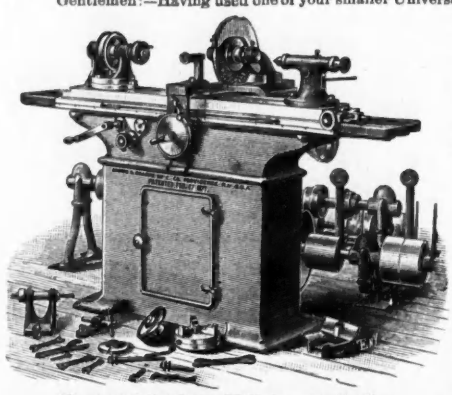
Gentlemen:—Having used one of your smaller Universal Grinding Machines for four years, and another of the larger size for nearly two years, it gives us pleasure to say that they produce economically and well all the kinds of work for which they are intended, and we could not dispense with them. Yours truly,
Wm. B. Bement & Son.



Wm. Sellers & Co., Philadelphia, Feb. 7, 1885.

Brown & Sharpe Mfg. Co., Providence, R. I.
Gentlemen:—In reply to your inquiry of the 6th inst., we have to say that we have been using your "Universal Grinding Machine" almost constantly since June, 1880, with very satisfactory results. We hope to add more to our plant as business increases. Yours truly,
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Brown & Sharpe Mfg. Co.,
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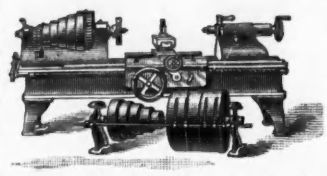

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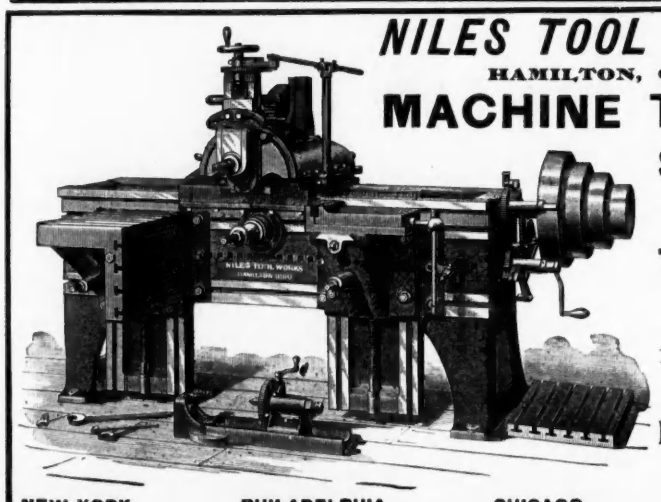

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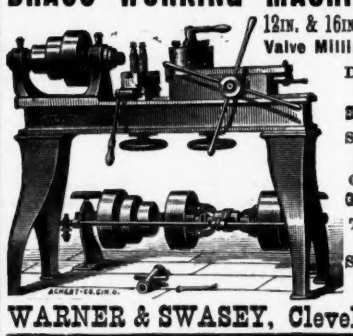

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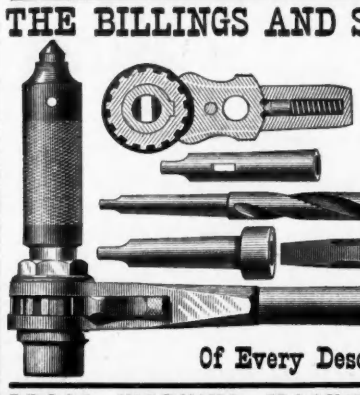

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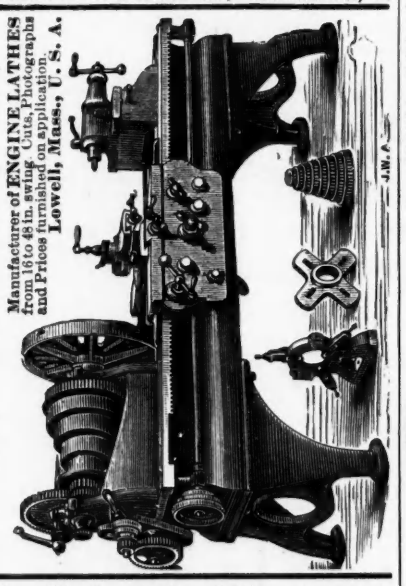

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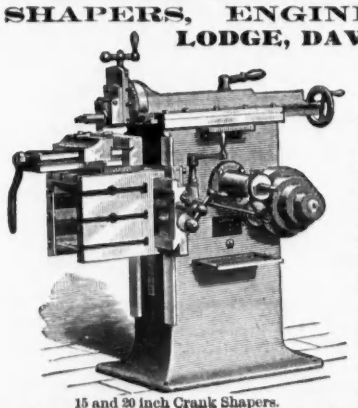

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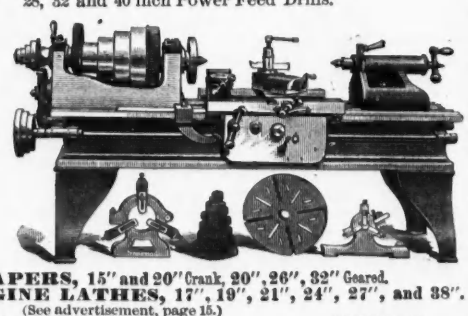

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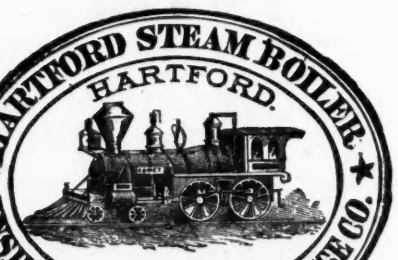

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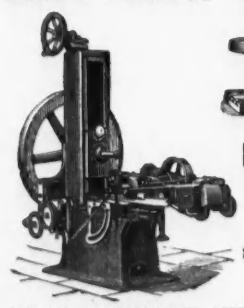

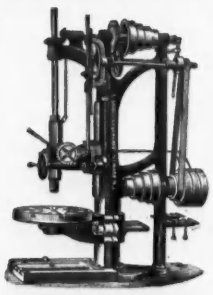

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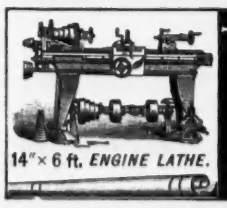

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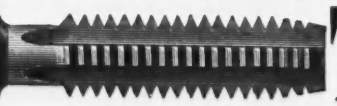

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